A DISSERTATION ON

"CLINICAL AND RADIOLOGICAL OUTCOME ANALYSIS OF TOTAL HIP REPLACEMENT."

Dissertation submitted to

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M.S. ORTHOPAEDICS

BRANCH- II

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THE TAMIL NADU Dr.M.G.R.MEDICAL UNIVERISTY

APRIL 2016

CERTIFICATE BY THE GUIDE

This is to certify that this dissertation titled " **CLINICAL AND RADIOLOGICAL OUTCOME ANALYSIS OF TOTAL HIP REPLACEMENT"** is the bonafide original work of **Dr.A.SUDHARSAN,** in the partial fulfillment of the requirements for M.S Orthopaedics (Branch II) Examination of The Tamil Nadu Dr.M.G.R Medical University to be held in APRIL 2016. The period of study is from 2013 -2015.

Prof.Dr.S.Kumaravel,M.S.Ortho.,D.Ortho.,Ph.D.,
Guide,
Professor of Orthopaedics and Traumatology,
Department of Orthopaedics and Traumatology,
Thanjavur Medical College, Thanjavur

CERTIFICATE

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Prof.Dr.M.GulamMohideen,M.S.Ortho.,D.Ortho.,
Professor and Head,
Department of Orthopaedics,
Thanjavur Medical College,
Thanjavur.

Prof. Dr.Singaravelu, M.D.,D.C.H.,
Dean,
Thanjavur Medical College,
Thanjavur.

DECLARATION

I**, Dr.A.SUDHARSAN** solemnly declare that this dissertation **"CLINICAL AND RADIOLOGICAL OUTCOME ANALYSIS OF TOTAL HIP REPLACEMENT"** is a bonafide work done by me at Government Thanjavur Medical College And Hospital between 2013–2016,under the guidance and supervision of **Prof.Dr.S.Kumaravel**, M.S.Ortho., D.Ortho.,Ph.D., Department of Orthopaedic Surgery.

This dissertation is submitted to The Tamil Nadu Dr.M.G.R Medical University towards partial fulfilment of regulation for the award of M.S Degree (Branch II) on Orthopaedic Surgery.

Place: Thanjavur
Date:

Dr.A.SUDHARSAN
Post Graduate
MS – Orthopaedics
Thanjavur Medical College
Thanjavur

ABSTRACT

Title: Clinical and radiological outcome analysis of total hip replacement.

Background: Fifteen adult cases of uncemented total hip replacements were assessed clinically (by Harris Hip Score) radiographically by serial radiographs and CT scan. In the postoperative Harris Hip Score the neck of femur groups and the arthritic hip groups had comparable results. Uncemented total hip replacement gives acceptable results in otherwise disabling condition of hip.

Keywords:

Osteointergration-direct structural and functional connection between ordered living bone and the surface of a load carrying implant, Bone ingrowth was evaluate radiologically by assessing radiodense regions and spot welds. Loosening- Radiolucent linesof more than 2mm at the bone - implant interface (in Gruen and DeLee and Chanley zones) with acetabular cup migration or femoral subsidence.

Materials and Methods:

Prospective evaluation of 15 patients in the age group of 18 years to 60 years with good general condition and no septic foci underwent uncemented total hip replacement for various indications between June 2013 to March 2015.

The periodic evaluation were done both clinically and radiologically with CT scan at regular intervals.

Results:

Among the 14 patients with 15 hip replacements(one bilateral) , the over all improvement in average Harris hip score was from 29.9 pre operatively to 91.4 post operatively and only in 1 case we observed deterioration in Harris hip score by loosening, but it still gave fair result.

Conclusion:

This is a short term study of one particular type of uncemented Total Hip Replacement system without comparison with matched or randomized group. In this study clinical assessment correlated well with radiographic apperance and CT scan. There were no evidences of osteointegration in any case possibly because of short duration of study. There was evidence of loosening in only one case. In the postoperative Harris Hip Score the neck of femur groups and the arthritic hip groups had comparable results.

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CONTENTS

Clinical and radiological outcome analysis of total hip replacement

Introduction

Sir John Charnley was the pioneer in Total Hip Arthroplasty .
From then on for the past 40 years total hip arthroplasty has proved to be an exceptionally satisfying procedure with the good results. By this procedure the quality of life of the said individual improves with functional improvement and almost in every patient if the procedure is done properly.

Professor Furlong was the pioneer of the total hip arthroplasty of the uncemented type .From the initial days of total hip replacement both the implant manufacturing (the tribology) and the way it is implanted into the human body have evolved. These methods have led to a big assortment of implant design, fixation types and bearing surfaces. For example the cemented, uncemented metal on metal, metal on ceramic, metal on polyethylene etc. Cementless total hip arthroplasty was based on the in growth of bone (Osteo-integration) achieving more dependable fixation of the prosthesis and at the same time facilitate the restoration of bone stock if a revision total hip arthroplasty is needed in future.

The process by which prosthetic components become firmly united (biological fixation) to the host bone by on growth or microscopic ingrowth of new bone is called **osteo integration.**

This is accomplished without bone cement to bond between the prosthetic implant and the bone. This growth of bone (Osteo integration) is studied radiographically by viewing the prosthetic bone interface for incorporation in the form of radio dense lines or loosening in the form of radiolucent zones.

The total hip replacement is an excellent option to reduce pain and increase mobility in otherwise hopeless conditions of hip.

Review of Literature

In uncemented total hip arthroplasty , the prosthetic fixation depends on bone ingrowth into a porous implant surface or bone on growth to a biologically active implant surface such as hydroxyapatite coating or sand blasting surface[31,34] .

With absence of texturing like sand blasting –rough surface, or absence of coatings like hydroxy apatite, on growth of bone cannot happen comfortably to achieve any long term implantation in patients with uncemented total hip arthroplasty. To achieve a reliable ingrowth of bone , the best possible pore size must be near that of a normal cancellous bone i.e. 100 to 400 μm. [3]

In uncemented total hip arthroplasty whatever the type of surface treatment that the implant had undergone (sand blasting – or coatings of hydroxy apatite, the main factor which will favour a good fixation in the long run is the immediate stability of the fixation that is achieved at the time of surgery. There are evidences that if the micromotion between the implant and bone is more than 50 μm it results in fibrous fixation and only below that degree of micromotion any bone ingrowth is possible. [3]

Coming to the acetabulum side , hydroxy apatite coated uncemented total hip arthroplasty acetabular sockets get osteointegrated and hence provide good clinical results. However if the bone is osteoporotic and if uncemented total hip arthroplasty is tried, then there is more chance of bone loss post operatively. Also an uncemented total hip arthroplasty with coated implants in which distal bone ingrowth have more risk of stress shielding.

Osteo integration (formation of new bone in prosthetic bone interface) is a good sign of stability in uncemented total hip replacement.

Pidhorz et al did radiological and histological correlation of bone implant in retrieved acetabular cup prosthesis and found that bone ingrowth. This new bone formation starts as early as one month postoperatively and with time the bone ingrowth increases and coverage of porous coating surfaces with bone. When the hip is reviewed later at an average of 41 months the incorporation of the implant is nearly complete .[1] Pidhorz also reported that due to the migration of particulate wear, a membrane like structure was formed around the prosthesis. The osteolysis in the diaphyseal part of the implant also correlated with the presence of corrosion products.

Various radiological features of osteo integration and stability were described by *Mulliken B.D et al* A" halo pedestal" is a thin radiodense lines surrounding the tip of implant. An incomplete shelf of dense bone at the tip of the stem is the'' shelf pedestal" and the new bones bridging endosteum and porous surface

of implant were called **endosteal spot welds**.. If there was no reactive lines around the porous surface, it was then called as **failed osteointegration**.[16]

Subsidence and qualitative remodeling of bone in uncemented total hip replacements were studied by *Peters et al* A measure from the tip of greater trochanter to lateral base of shoulder of prosthesis, gives an idea of subsidence of femoral component. If there was a difference of **2 mm** in a 6 months period then it is called **subsidence**. If there was a difference of 2mm to 4 mm in one year period then it is called a **progressive subsidence.**[2]

Quantitative remodeling of bone is assessed on the basis of

1. **Presence and extent of periprosthetic lines**
2. **Sclerosis of calcar and**
3. **Formation of bone plug distal to stem**

If there was migration of acetabular component more than 2mm, it is considered as sign of instability. Sclerosis of the medial portion of neck and distal bone plug is linked with femoral subsidence.

In the absence of growth of bone into the proximal aspect of the stem, femoral stem begin to subside, so host bone is loaded essentially in the medial cortex.

This motion of stem produces reactive bone at the tip of the stem. Such reactive bone becomes mature to appears like a thick plug completely filling the medullary canal at that site (at the tip of the stem).

A simple classification system is proposed by *Engh and Bobin* [10] for implant fixation was based on roentegenographic examination alone. The fixation was classified as[4]

(1) bone ingrowth

(2) stable fibrous and

(3) unstable.

Fixation by bone ingrowth is defined as an implant with no subsidence and minimal or no radiographic lines formation around the stem and the bone implant interface appears stable.

Hypertrophy of the cortex may be present at the distal end of the porous surface and spot welds may be evident between stem and endosteum.(fig-1)

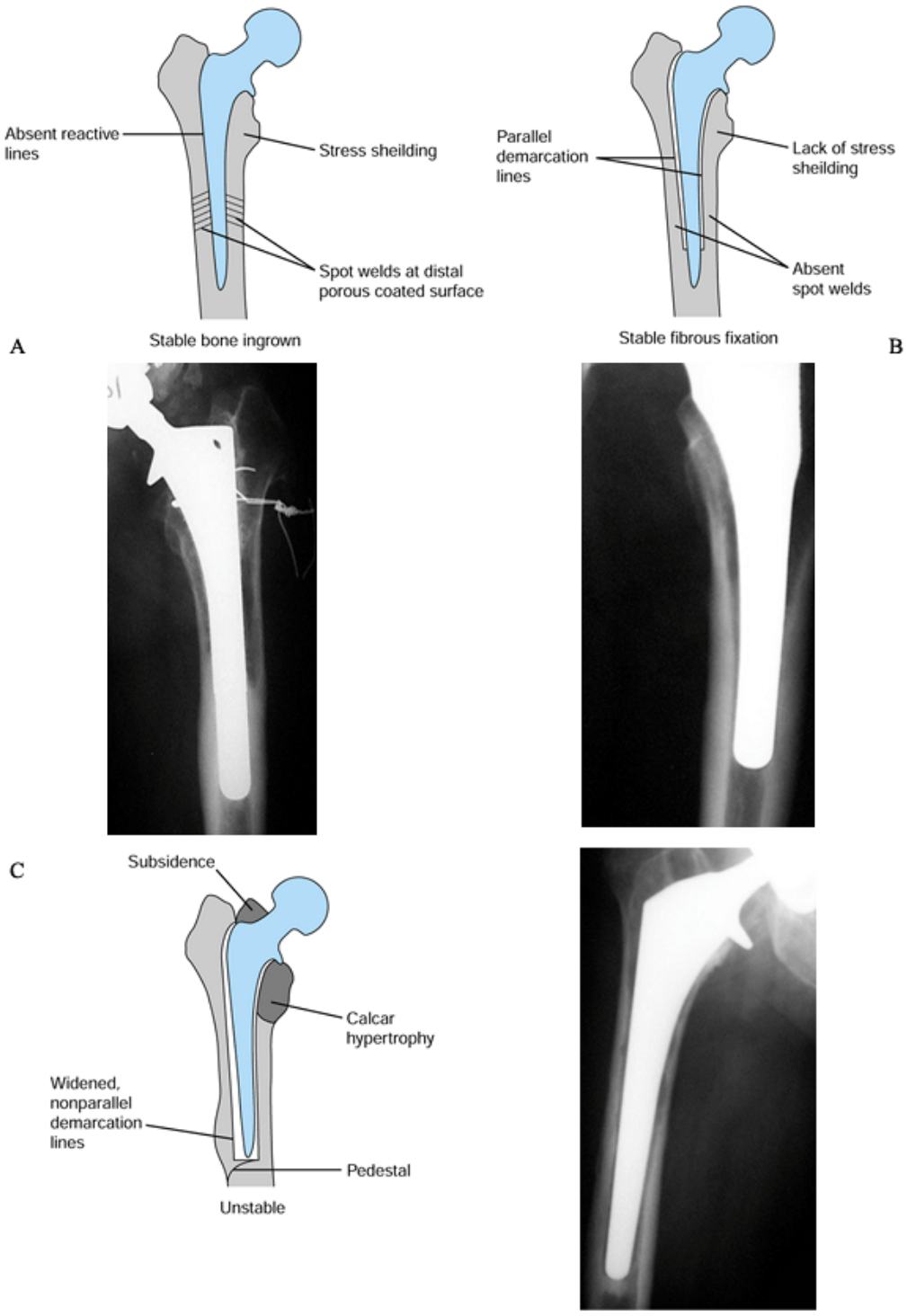


Fig-1 Osteo intergration(endosteal spot welds)

An implant is stable even with fibrous ingrowth when no progressive migration occurs but an extensive radio opaque line forms around the stem. These lines surround the stem in a parallel manner but separated from the prosthesis stem by means of an 1 mm radio lucent line.

Formation of trabeculae into the bone that is grown on the implant indicate osteointegration. Incomplete sclerosis and osteolytic lines close to the impant denote instability. For example radiolucent lines in the interface between implant and bone shows loosening. However if there is **incomplete radiolucent lines** between **pedestal.** It is not indicative of loosening. Plain radiography can misjudge the degree of osteolysis and osteointegration. CT is of assistance in differentiating the type of lesions that was first seen in radiography. [5]

If there is development of subsidence or migration within the femoral canal and partially surrounded by divergent radiographic lines that which just separated from the implant stem at its extremities, then such an implant is called **unstable implant.**

To achieve and maintain the stability, three stages of primary healing like that of bone fracture healing, occur at the porous surface of implant and bone interface.

1. Initial inflammatory phase
2. Reparative woven bone (one to two weeks.)
3. Lamellar remodeling bone (four weeks)

Such bone is of intramembranous origin type. As one is aware only in excessive relative movement between the surfaces , then cartilaginous bone or fibrous tissue can form. [3]

Improvement in bone ingrowth otherwise called osteointegration depends on the accomplishing stability between the bone and implant. Experimental studies show that it has been found that calcium phosphate treatment of porous surface, stimulation of implant with direct current and given systemically enhanced good fixation and apposition of prosthesis to bone. [6]

However increased motion at the porus surface bone interface, inhibits this bone growth.

Also it is obvious that factors affecting fracture healing can also inhibit bone ingrowth in uncemented total hip replacement components for example drugs like indomethacin, bisphosphonates and low dose radiation therapy which are used to treat heterotrophic ossification can reduce the bone ingrowth even upto 75 percent.[63]

Anatomy Of Hip Joint (Fig-2)

The femoral head articulating with the cup-shaped acetabulum makes the hip joint a ball-and-socket multiaxial joint. The centre of the joint lies just below the middle third of the inguinal ligament. The contour of the joint's ventral margin and middle third of inguinal ligament are parallel . In gross appearance the articulating surfaces may appear symmetrically curved but actually both these two surfaces are not fully congruent. For example in position of full extension with slight abduction and medial rotation there is a crammed position is in full extension,.

The articular cartilage covers the head of the femur, except for a rough pit for the ligamentum teres . Its maximum thickness is in the centre. Anteriorly the cartilage extends laterally over a small area on the neck, .

The acetabular articular surface is an imperfect ring, there is a lunate surface which is , broadest above carries the body weight falls when the person stands erect., the narrowest part is anteriorly in the pubic region.

It is deficient below opposite the acetabular notch and covered by articular cartilage,it is thickest where the surface is broadest.

The acetabular fossa within it has no cartilage but has fibro-elastic fat largely covered by synovial membrane.

Further the acetabular depth is augmented by a fibrocartilaginous acetabular labrum, which bridges the acetabular notch by the transverse acetabular liagement.

Ligaments of hip joint are the iliofemoral, ischiofemoral, pubofemoral and as described below, the ligament of the head of the femur (Fig-2a,2b,2c)

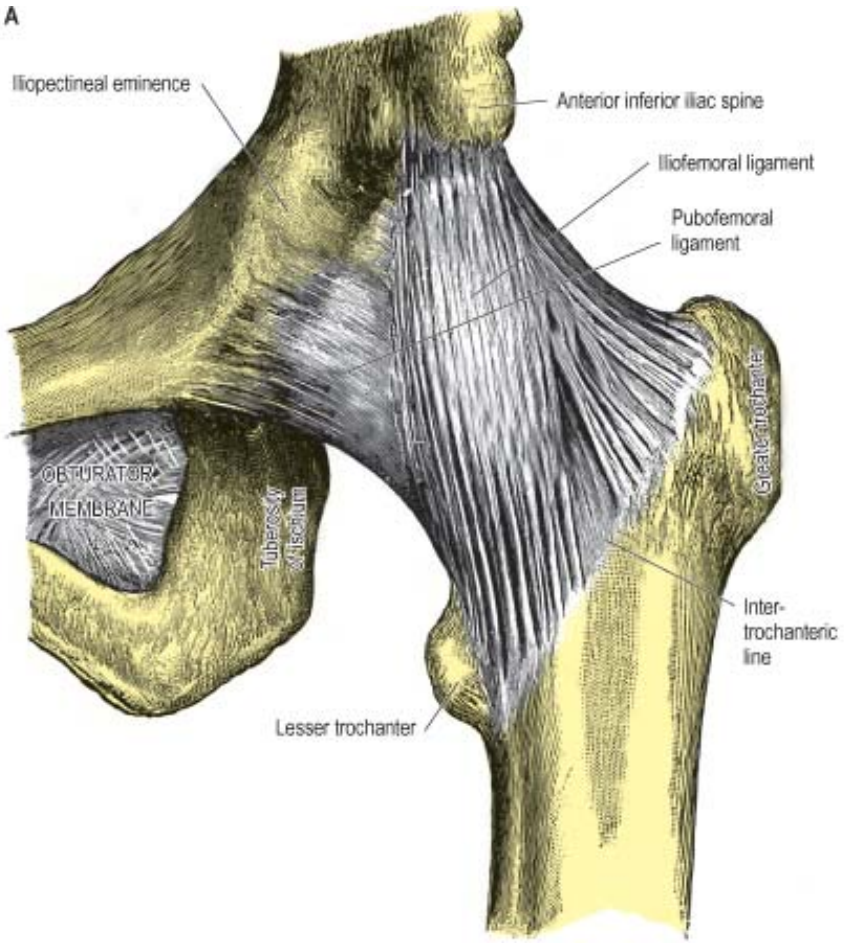


Fig -2a .Anatomy of hip joint- from front

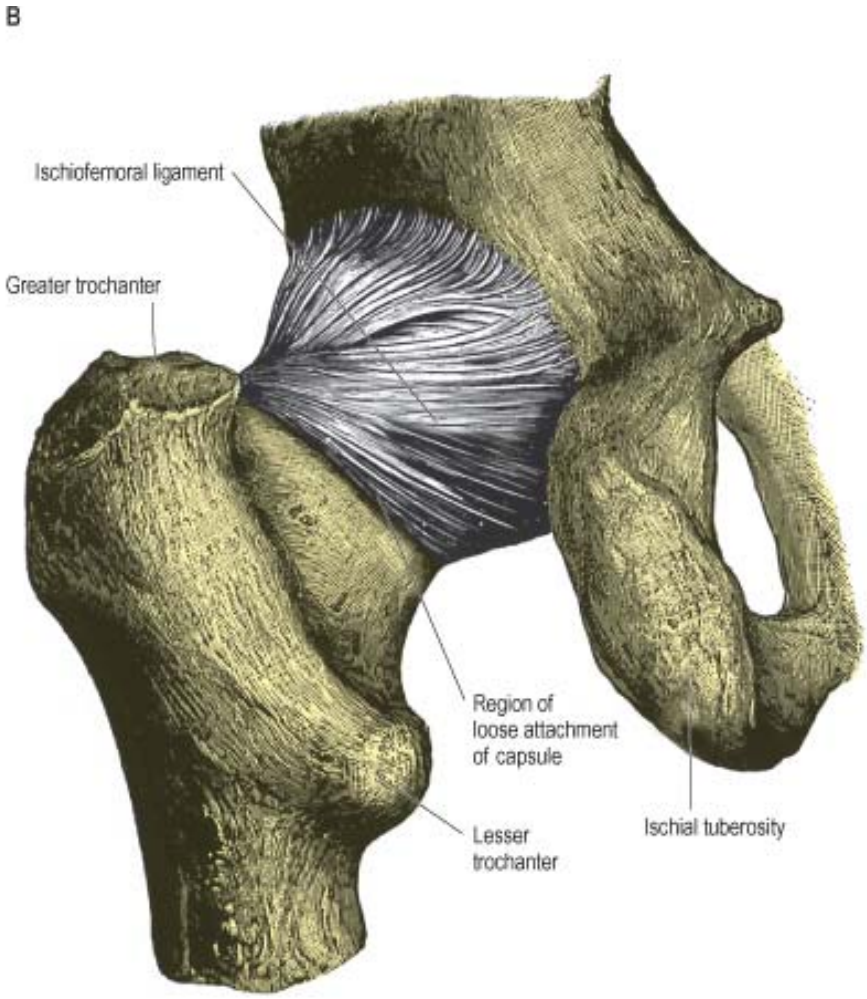


Fig-2b Anatomy of hip joint-from behind

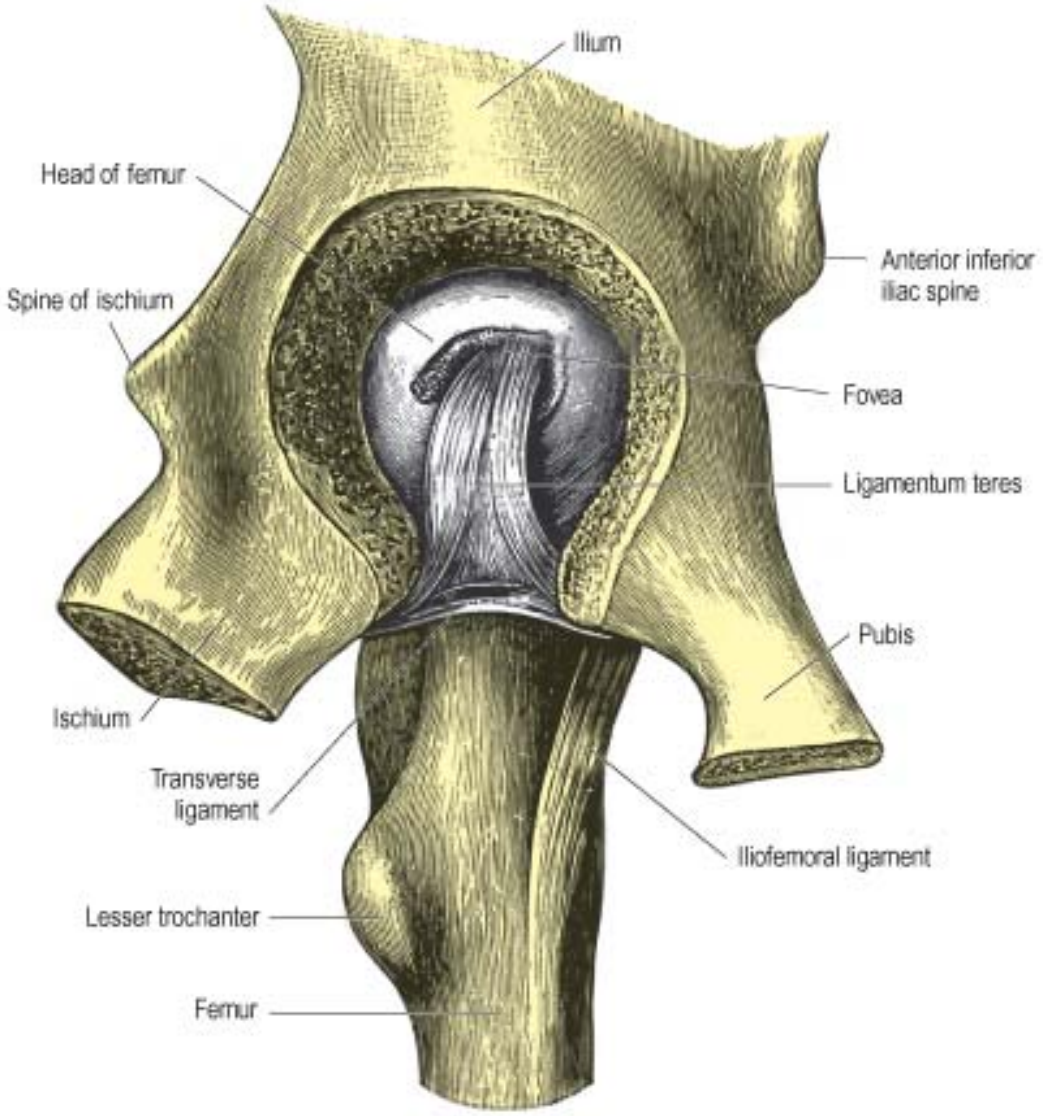


Fig-2c Anatomy of hip joint-from side

The ligament of the head of the femur is a triangular flat band, with its apex attached on the anterosuperior aspect of the pit on the femoral head.

The base is attached on both sides of the acetabular notch which also blends with the transverse ligament.

This is sheathed by flat- tubular synovial membrane, strength is variable.

Sometimes the synovial sheath alone is there without the central ligament

Sometimes both the ligament and its synovial sheath are absent.

When the thigh is semiflexed and adducted, ligamentum teres become tense and it becomes to relax in abduction.

The Capsule

It is dense and strong and is attached 5-6 mm ahead of acetabular labrum, above the acetabular margin . The capsule is attached in front to the outer labral aspect and inferiorly close to the acetabular notch, it is attached to the transverse acetabular ligament and the adjacent rim of the obturator foramen, the capsule surround the femoral neck and inferiorly gets attached anterior to the intertrochanteric line of femur; above to the base of femoral neck. Also in the lower aspect it is attached , posteriorly about 1 cm above the intertrochanteric crest, and to the femoral neck near the lesser trochanter.

Anteriorly many fibres go up along the neck of femur in the form of the longitudinal retinacula, along with blood vessels for head and neck of femur .

The capsule is thicker antero superiorly,where maximal stress occurs, particularly in standing over the head and neck

However the capsule is thin and loosely attached posterioinferiorly.

1.The internal fibres are circular fibres called the Zona orbicularis. It forms a collar around the femoral neck and becomes partly blended with the pubofemoral and ischiofemoral ligaments. These internal fibres are not attached to bone directly.

2. The external fibres are longitudinal fibres that are more pronounced in anterosuperior aspect where the capsule is thick. The external fibres are reinforced by the iliofemoral ligament.

Further the capsule is also reinforced by the pubofemoral and ischiofemoral ligaments. The capsule is rough, on the outer and is covered by muscles and a bursa separates it from the ilio psoas (fig 3)

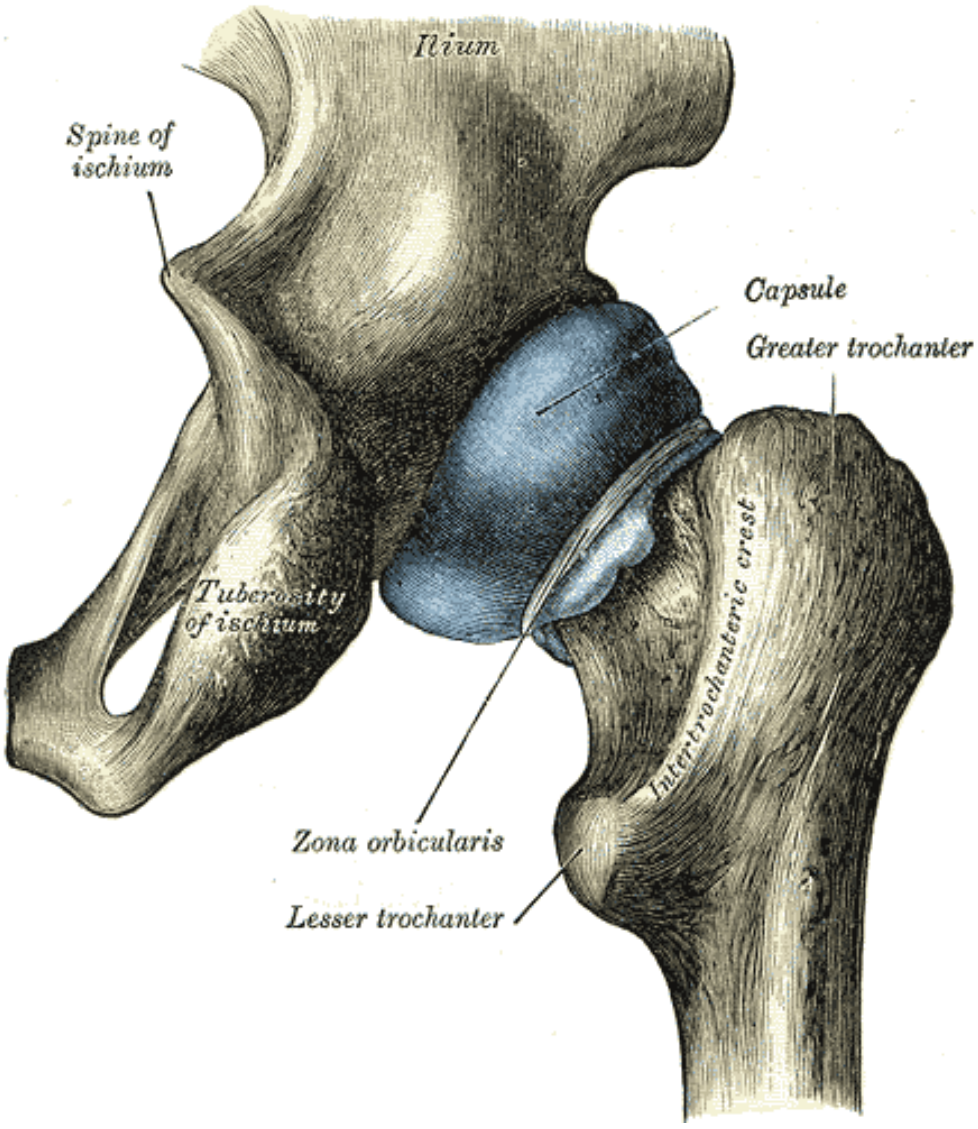


Fig-3 Anatomy of hip joint- Capsule

Synovial Membrane

Synovial membrane starts from femoral articular margin, covers the intracapsular region of the femoral neck, then continues to cover internal surface of the capsule and passes on to cover the acetabular labrum, ligament of the head and fat in the acetabular fossa. It is thin or even absent on the deeper surface of the iliofemoral ligament as it is compressed against the femoral head .

There may be a communication of the joint with the subtendinous iliac (Psoas) bursa in the form of a circular aperture between the pubofemoral ligament and the vertical band of the iliofemoral ligament.

Relations Of The Hip Joint

The hip joint is deep seated and is surrounded by muscles.

In anterior aspect, lateral fibres of pectineus, psoas major, with iliacus, with bursa separating the capsule and the muscles.

The femoral artery is anterior to the tendon; the femoral nerve deep in a groove between tendon and iliacus.

In lateral aspect, the straight head of rectus femoris crosses the joint along with a deep fascial layer of the iliotibial tract.

In the superior aspect, there are two muscles, the reflected head of rectus femoris and gluteus minimus.

In the inferior aspect, lateral fibres of pectineus , obturator externus are there.

In the posterior aspect , the lower capsule is covered by the tendon of obturator externus, separating it from quadratus femoris and accompanied by an ascending branch of the medial circumflex femoral artery; above this the tendon of obturator internus and the gemelli are there, separating it from the sciatic nerve. The nerve to quadratus femoris is deep to the obturator internus tendon, the nerve descending most medially on the capsule. Superiorly the joint's posterior surface is crossed by piriformis.(fig- 4)

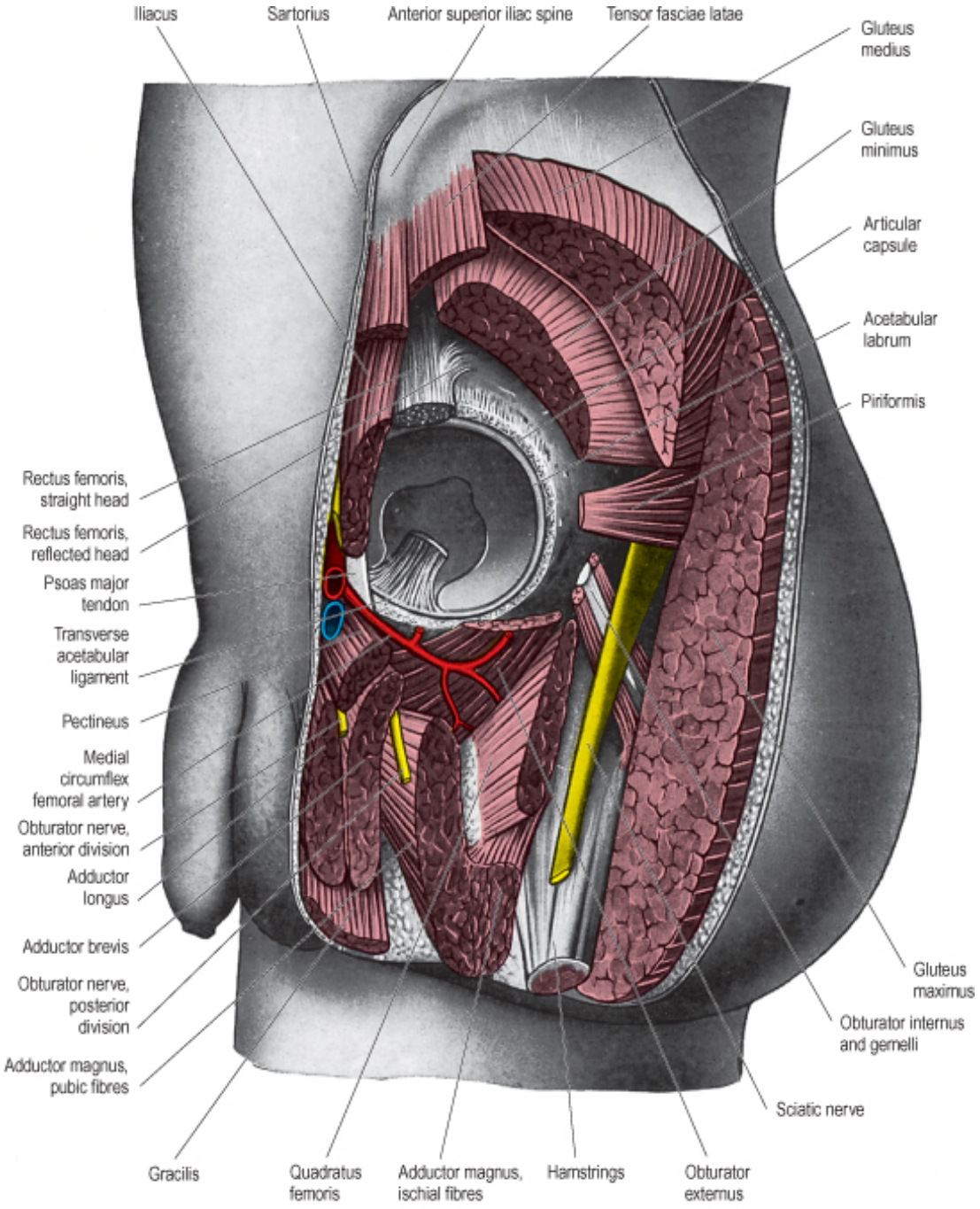


Fig-4 Anatomy-Relations of hip joint

Vessels And Nerve Supply To The Hip Joint

Hip joint is supplied by the articular arteries which are branches from the obturator, medial circumflex femoral, superior and inferior gluteal arteries.

The nerve supply are from the femoral or its muscular branches, the obturator, accessory obturator, the nerve to quadratus femoris and the superior gluteal nerves.

Movements Of The Hip Joint (Fig-5)

Movements of the hip joint are flexion-extension, adduction - abduction, , medial and lateral rotation and circumduction. These can be considered as rotations around three orthogonal axes.

As the thigh is flexed or extended, the femoral head ‘spins’ in the acetabulum around an approximately transverse axis. but the acetabulum rotates over similar axes in flexion and extension of the hip on femoral heads.

Medial and lateral femoral rotation have a vertical axis through the centre of the femoral head and lateral condyle, with the foot stationary on the ground.

Abduction and adduction happen around an anteroposterior axis through the femoral head; but as the head is not really spherical.

Mechanical axis is considered to be coincident with the topographical long axis of the femoral neck, impinging on the approximate centre of its head's articular surface causing extension and flexion of the thigh relatively rotate at the hip joint and most effective in tightening or relaxing the capsular ligaments.

Simple flexion is possible to 90^0 – 100^0 from the neutral ; extension beyond the neutral is limited (Perhaps 10^0-20^0) .

Both these movements are augmented by adjustments of the spinal column and pelvis, flexion of the knee and concomitant medial or lateral hip rotation.(If there is knee flexion, lessening tension in the hamstrings can increases hip flexion to 120^0).

Extension in walking, running can be increased by inclination of the body, pelvic tilting and hip rotations, same is the case with abduction and adduction .

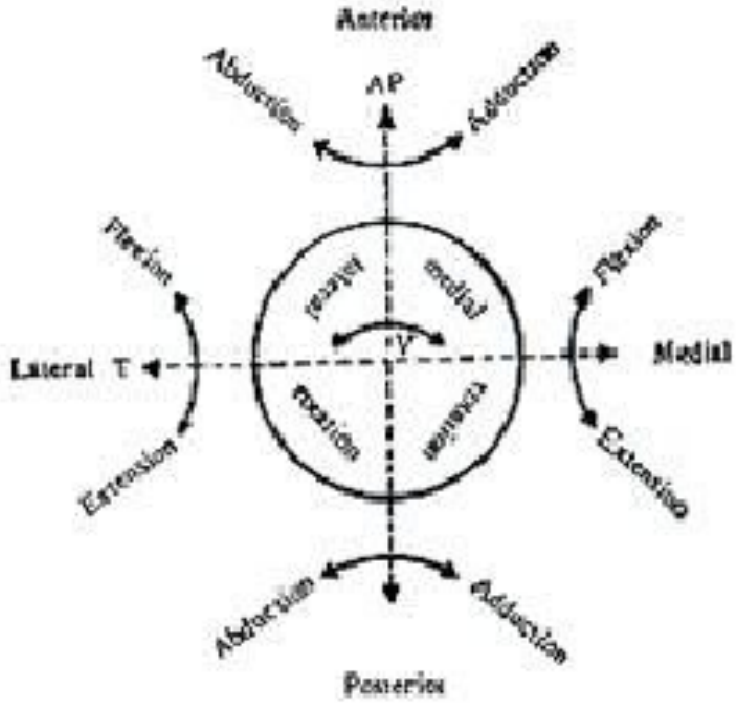


Fig-5 Movements in hip joint

Forces That Are Acting On The Hip Joint.

The forces transmitted across the hip joint vary accordingly with activity; during single limb stance as high as of **2.1 times body weight can pass through the hip**. While during gait phase in stance phase forces of upto 2.6-2.8 times body weight can pass through the hip (fig-6)

The highest hip contact pressures, recorded over a 36-month period, were the consistent area which receive more localized high loading is the superior and posterior regions of the acatabulum.. This is the region of degenerative change.

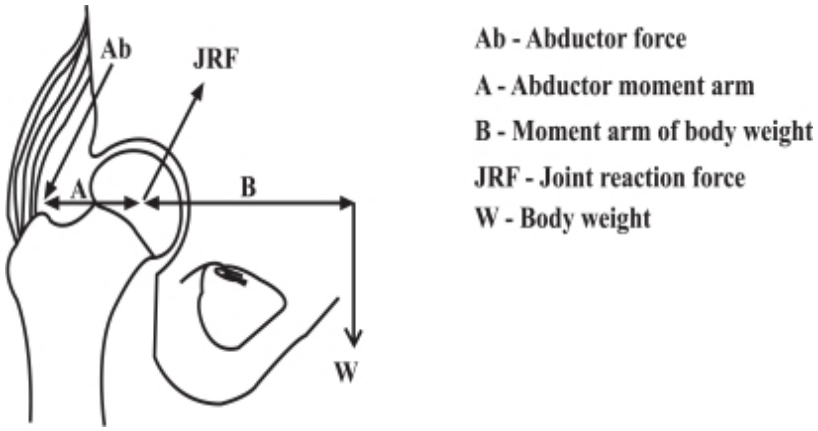


Fig-6 Biomechanics of hip joint

Indications of Total Hip Replacement

The main indications for total hip replacement are **pain** in the hip joint and **loss of function**. Such a hip pain is typically felt over the groin , greater trochanter and sometimes radiating down the anterior aspect of the thigh to the knee.

This distribution reflects the innervation of the joint from the branches of the Sciatic, Femoral and Obturator nerves. Stiffness, fixed deformity, shortening of the affected are the main problems that can happen in any arthritic hip . There can be limping also.The pathologies that usually need hip replacement are osteoarthritis and rheumatoid arthritis; other conditions include psoriatic arthritis, ankylosing spondylitis, avascular necrosis, fracture of the neck and head of femur , post traumatic arthritis,tuberculosis and sometimes tumors.

Aim Of The Study

To find clinical and radiological outcome of the cementless total hip arthroplasty

Materials and Methods

Prospective evaluation of 15 patients in the age group of 18 years to 60 years with good general condition and no septic foci underwent uncemented total hip replacement for various indications, between June 2013 to March 2015 at the Department of Orthopaedics and Traumatology , Thanjavur Medical College Hospital.

These patients had periodic evaluation both clinically and radiologically and with CT scans at regular intervals (3 weeks, 6 weeks, 3 months, 6 months and yearly thereafter)

Indications

Indications in our study for cementless hip replacement were as follows

Inclusion Criteria

Otherwise healthy patients with good bone stock and no evidence of septic foci preoperatively

- Avascular necrosis head of femur,
- Old Fracture neck of femur non union
- Chronic arthritis of hip

Exclusion criteria

- Otherwise healthy patients with poor bone stock or with evidence of septic foci preoperatively were excluded.

Surgical Approach (Fig-7)

We used posterior **Moore's approach** in all the patients .

First step is an **adductor tenotomy** in old chronic arthritis cases and old neglected fracture neck of femur cases. The patient is placed in lateral position with the affected limb on the upper aspect . An incision is started 5 cm posterior and lateral to the postero inferior iliac spine and proceeded towards greater trochanter and then along the line of shaft of the femur. The fascia lata is incised in line with the skin incision and centered over greater trochanter and it is divided.

The gluteus maximus is divided along it fibers and retracted with Charnley's self retracting retractor exposing the origin of the lateral rotators of the hip on the greater trochanter . Tendons of short lateral rotators are cut 1cm from the greater trochanter and are retracted medially protecting the Sciatic nerve in the process. .

The incision is carried distally along the shaft also to aid exposure.

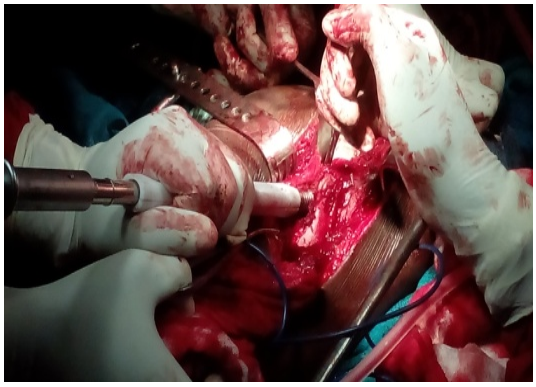
The psoas tendon is erased off the lesser tuberosity

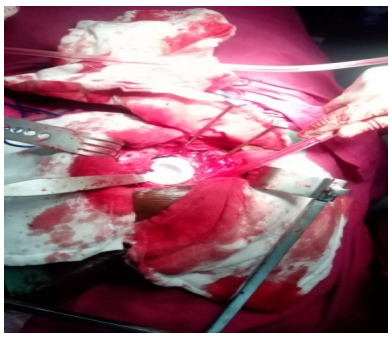
The thigh is internally rotated and the capsule of the joint is exposed and incised. Hip is dislocated by internal rotation.

In case of fracture of neck of femur the head is delivered by a Murphy's skid or by a corkscrew.

FIG-7 THE STEP BY STEP PROCEDURE WITH AVERAGE TIME IS GIVEN BELOW

S.NO	STEPS	AVERAGE TIME(min)	INTRA-OP PICTURES
1.	Spinal Anaesthesia Positioning & Painting	15	
2	Draping	5	
3.	Incision and superficial layer dissection	2	

S.NO	STEPS	AVERAGE TIME(min)	INTRA-OP PICTURES
4.	Deep layer dissection and Release of SER and Capsule (SER-Short External Rotators)	15	
5.	Head retrieval	2	
6.	Acetabular reaming	15	

S.NO	STEPS	AVERAGE TIME(min)	INTRA-OP PICTURES
7.	Trial cup	3	
8.	Acetabular cup insersion	2	 
9.	Liner insertion	2	

S. NO	STEPS	AVERAGE TIME(min)	INTRA-OP PICTURES
10.	Femoral broaching	10	
11.	Trial stem/neck and head followed by reduction reduction	5	
12.	Stem inserted	2	
13	Head Inserted	1	

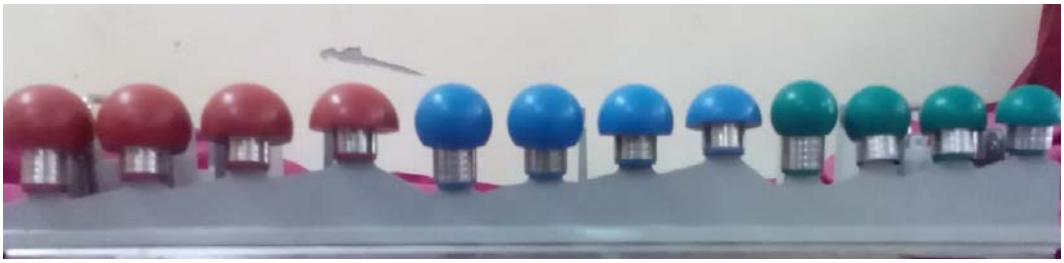
S. NO	STEPS	AVERAGE TIME(min)	INTRA-OP PICTURES
14	Reduction and Testing movements	1	
15	Shuck test	1	
16	Closure	10	

Instruments

For acetabular preparation

For femoral preparation

Standard offset



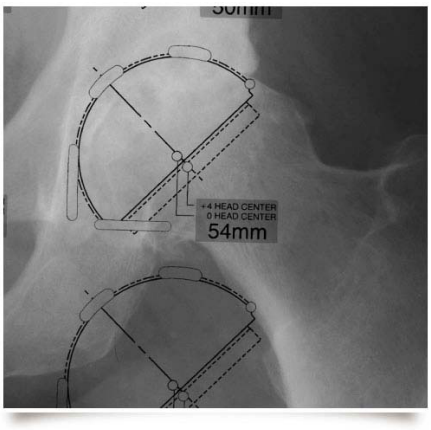
Femoral trial head of variable size

Fig-8 Instruments used in Total Hip Replacement

Implants

The cup and stem size were determined by pre operative planning with templates (fig-9)

Fig-9



1) Two horizontal lines are drawen, one joining both teardrop and the other joining the lesser trochanter, limb length discrepancy is measured as the difference in lengths of lesser trochanters.

2) Acetabulum: acetabular templates are placed on the flim and a size that closely matches the contour of patients acetabulum is selected. The medial surface of the cup is at the tear drop and the inferior limit is at the level of obturator foramen. The new center of rotation of hip is marked.

3) Femur: A size is selected that most precisely matches the contour of proximal canal . Select a neck so that the difference in the height of femoral and acetabular center is equal to the limb length discrepancy.

4)The level of anticipated neck cut is marked and measure its distance from the lesser trochanter.

In total hip replacement preoperative templating to determine lateral and anterior inclination of the cup is important to avoid postoperative problems like impingement, dislocation, high wear rate and loosening. Charnley [64] recommended 0 degree of anterior inclination, Coventry [65] recommonded 40 degree of lateral and 15 degree of anterior inclination, and Harris [66] recommended 30 degree of lateral and 20 degree of anterior inclination. Based on these studies, cup inclination angle typically ranges from 30 to 50 degree lateral and 0 to 30 degree anterior.

In patients with osteoarthritis of the hip joint the position of the femoral head on the healthy side can be used as a point reference .However, in patients with bilateral osteoarthritis there is no physical point of reference apart from the height of the teardrop.

Ranawat et al[69] proposed using the true acetabular region as the area of cup position and the approximate femoral head center as the reference (fig-10).

The approximate femoral head center was determined by placing the cup at an inclination of approximately 45 degree lateral and 25 degree anterior.

The cup size was selected to fit the anteroposterior acetabular diameter and to contact the medial wall of the acetabular floor in depth. The inferior cup edge was placed at the level of the inferior acetabular margin.

Fig-10 Ranawat triangle

S_1S_2= Shenton's line K_1K_2=Kohler's line

The lowest point of the teardrop is the intersection of S_1S_2 and K_1K_2

CD=20% height of pelvis

The implant on the acetabular side is the standard cup- modular acetabular implant consisting of a titanium shell and a polyethylene liner insert. (Fig 11) The outer titanium shell consists of a convex outer surface, which is rough sand blasted surface to enable osteointegration.

In its proximal half this shell has openings for proper cancellous bone screws, which are countersunk and need to be inserted parallel to the leading direction i.e. towards the sacro iliac joint. These countersunk screw heads do not protrude above the inner surface interfering with the polyethylene insert because the screw sockets were recessed into the concave inner surface of the titanium shell.

These screw sockets also allows positioning of screws at any angle within a 30^0 range. The screw sockets have a hemispherical form with a sharp edge and

the outer shell surface. Such sharp edges makes sure the anchorage of the implant in the cancellous acetabular bone even when in some cases no fixation screws were used.

The screws used are of 6.5 mm diameter countersunk cancellous screws made of titanium and the head has a hexagonal recess. The above screw are inserted in the safe zone quadrant of Wasielewski (fig-11)

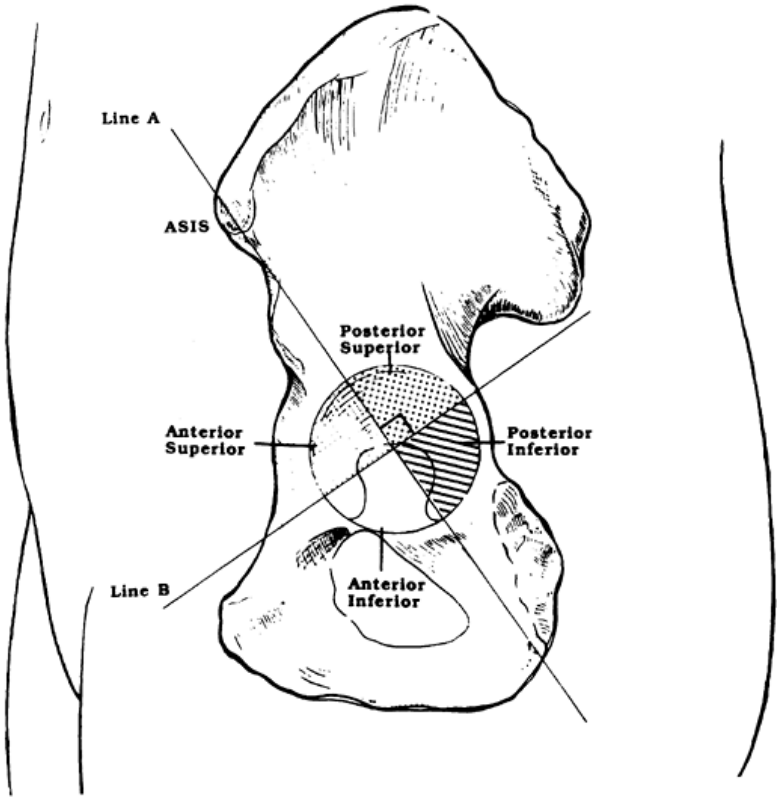
In the distal half of the shell there were no screw opening so that screws were not inserted even erroneously. There were sharp edged elevations, which can penetrate into the cancellous bone, when the cup is impacted. Thus increasing the primary stability like prevention of rotation and tilting..These will also offer a large surface area for subsequent osteointegration.

A slightly greater diameter of the implanted cup shell than the previously reamed acetabulum , ensures primary stability . Thus the implant was pressed into a bone hollow which is somewhat slightly smaller by 2mm. This causes high circular tension, surrounding the implanted cup. The standard cup was available in 2mm steps with diameter from 44mm to 62 mm.

The threaded hole at the pole of the titanium shell served for mounting on the cup- setting instrument. Also the pin on the convex pole of the high density polyethylene insert fit into this central hole and can be used as a guide for insertion into the titanium shell. As it is impacted into the outer titanium shell ,the polyethylene insert becomes wedged behind the recess around the edge of the titanium shell and snap into position. Uncemented direct anchorage of the

titanium shell in the acetabulum is by press-fit and later by osteointegration. If necessary extra screw fixation can be done.

Fig-11 Quadrants of Wasielewski(safe zone-posterosuperior)



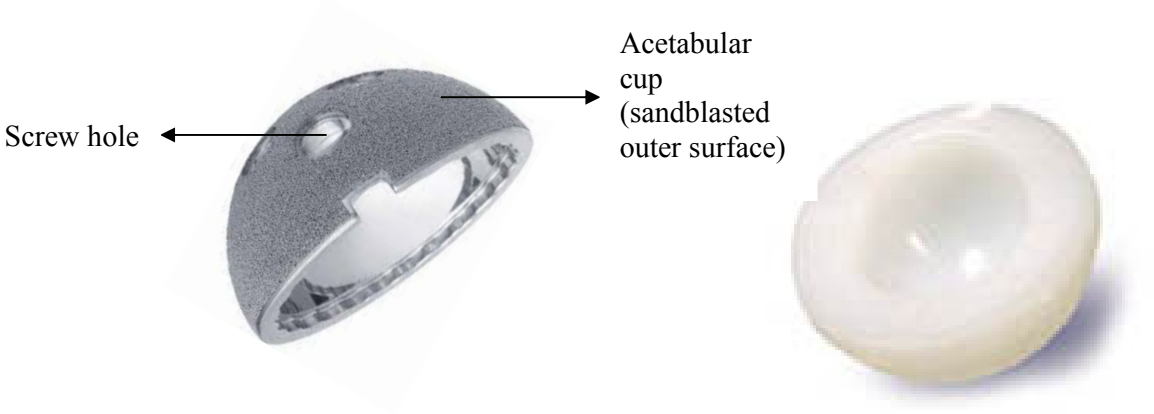


Fig-12 Acetabular implant - outer titanium shell with sand blasted surface and polyethylene liner

Fig-13 Femoral stem component (titanium alloy with hydroxyapatite coated)

The uncemented femoral stem component was made up of a titanium alloy of high strength with a rough sand blasted finish. This implant was used along with a modular head made up of cobalt –chromium – molybdenum alloy. The inner hollow of the head comes in different depths making the necks of various lengths (fig-13).

Just like the acetabular cup implantation , for femoral stem also ,the three-dimensional press fit gives immediate mechanical stability .

The frontal and sagittal planes of the femoral prosthesis is conical while the anterior and posterior proximal surfaces of the stems have parallel, longitudinally arranged conical ribs. The stem's rotational stability was achieved by means of these ribs, which will connect and bond into proximal cancellous bone. The optimal fit was achieved by press fitting of the stem in the femoral medullary canal.

All these cases were evaluated with HHS and clinical scoring done.

All these cases were evaluated radiologically by radiographs and CT scans and the results were noted.

The patients were grouped according to age and sex. All patients were available for follow up. As far as possible periodic review was done by clinical evaluation immediate post operatively and after 3 weeks, 6 weeks, 3months, 6 months and yearly. The follow up was done by the same author on appropriate dates. To evaluate the patients preoperatively and post operatively we used Harris hip score. Specific questions were put if there was **anterior thigh pain** or not .

They were evaluated for complications like intra operative periprosthetic femoral fractures, superficial infection, dislocations, post operative limb length discrepancy wasting of thigh and clinical evidences of loosening of prosthesis [24].

Illustrated cases

Case 1

18 year old male came with complaints of pain in right groin and limping for the past 6 months.

The pain was progressively increasing in intensity,radiating to knee , throbbing ,aggravated during activities like squatting , cross leg sitting and climbing stairs and pain was not relieved by rest.The limp was gradual in onset and progressively increased.He had no other associated injuries and co morbidity. He had history of trauma due to road traffic accident 2 years ago for which he underwent Open reduction and internal fixation with cancellous screw fixation of fracture neck of femur of the right side.He had pain free period of 6months.

He was admitted at our department. He was examined for limb length discrepancy,fixed deformities, available active and passive range of movements at the affected hip, Also noted any distal neurovascular deficit ,status of other joints and any focus of infection(skin,dental and urinary tract). His was subjected to preoperative Harris Hip Scoring system analysis, it was found to be 39.

He has been diagnosed as posttraumatic avascular necrosis femoral head right side.

He was assessed for suitable anaesthesia for cementless total hip replacement of left side hip and obtain consent for total hip replacement to improve in quality of life.

He was operated on 07-12-14 and operation was uneventful..He was transported in supine position with operated limb abducted by a pillow. In the postoperate ward he was connected to multipara monitor to monitor his vitals. He was also monitored for urine output,dressing soakage and wound drain output..He was permitted to lie in lateral position on the nonoperative side while maintain the pillow between the knees to prevent bedsore formation. He was encouraged ankle and toe mobilization in bed as soon as the motor function recovers from spinal anaesthesia..

Analgesics and proton pump inhibitors were continued for 48-72hrs.IV antibiotics(PiperacillinandTazobactum) was continued for 48hrs and put on oral antibiotics afterthat for 5-7days.Thrombo-prophylaxis involves subcutaneous Low Molecular weight Heparin(Enoxaparin) was started 12 hrs after the surgery.

Hb% and Packed Cell Volume(PCV) were checked and blood transfusion was decided only if Hb was <9mg% and PCV<27%.

The suction drain was removed after 24hrs as the drain was < 150ml.

He was given physiotherapy in bed on the first post operative day. Static glutei,abductors and quadriceps exercises were started. He was encouraged prop up position and chest physiotherapy and was made to sit up in the bed and also with the legs hanging by the side of the bed but was strictly advice to continue the abduction pillow the thigh and not to lie on the operated side for 3-6 weeks.

On the third postoperate day he was made to stand up and walk with partial weight bearing using a walker. A high western commode seat toilet was advised for 3 months.

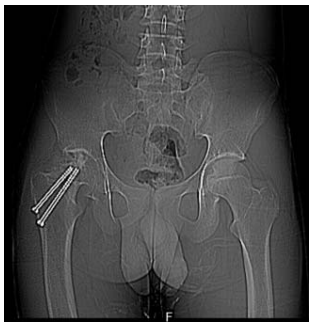
He was discharged after removal of sutures on 15th postoperate day.

He was advised care at home, with supervised physiotherapy and also to continue walker for 6 -12 weeks and followed by cane in the contralateral side and to avoid stair climbing upto 6-12 weeks. He was advised to followup at 3weeks,6 weeks,3months,6months and half yearly for followup. He had Harris HIP Scoring and radiological evaluation for acetabular cup migration,femoral stem subsidence,loosening and osseointegration using pelvis radiograph with both hip and Computed Tomographic scan of pelvis with both hips.

CASE- 1

PREOP CLINCAL PHOTO

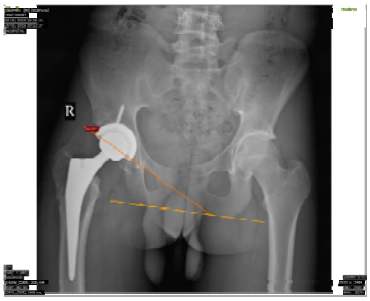
PREOP X-RAY



POST OP CLINICAL ASSESSMENT

POST OP RADIOLOGICAL ASSESSMENT

LLD (X-RAY)



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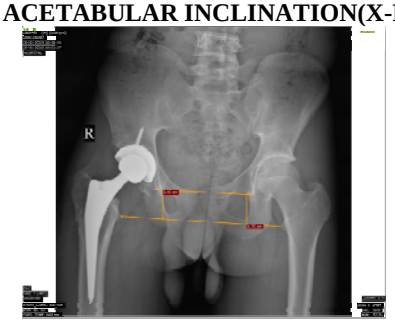
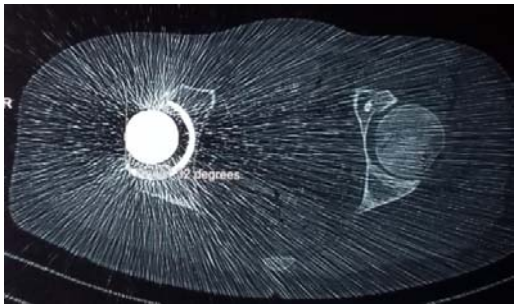
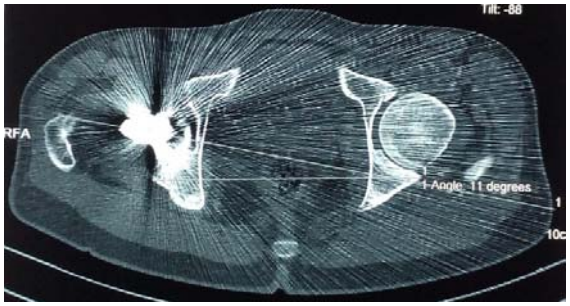


ACETABULAR CUP ANTEVERSION(CT)



FEMORAL STEM ANTEVERSUION(CT)



Case 2

36 year old male came with complaints of pain left groin and limp for the past 2 years and 1year respectively.

The pain was progressively increasing in intensity, radiating to knee , throbbing aggravated during activities like squatting , cross leg sitting and climbing stairs. Limp was gradual in onset and progressively increased. He had no other associated injuries and co morbidity. He had road traffic accident two years ago for which he underwent native treatment of left hip injury followed by conservative line of management by orthopaedician. He was admitted at our department and underwent all necessary investigations. He had lower limb shortening,adduction and external rotation deformity of the affected hip with no distal neurovascular deficit. Status of other joints were normal and he had no focus of infection (skin, dental and urinary tract). He has been diagnosed as posttraumatic coxavara with secondary osteoarthritis left hip joint.

He was subjected to preoperative Harris Hip Scoring system analysis. He was assessed for suitable anaesthesia for cementless total hip replacement of left side hip after a fair trial of conservative management and obtain consent for THR to improve in quality of life.

He was operated on 13-10-14and intraop was uneventful..He was transported in supine with operated limb abducted by a pillow. In the postop ward he was connected to multipara monitor to monitor his vitals. He was also

monitored for urine output, soakage and drain output..He was permitted to lie in lateral position on the nonoperative side while maintain the pillow between the knees to prevent bedsore formation. He was encouraged ankle and toe mobilization in bed as soon as the motor function recover from spinal anaesthesia.

Analgesics and proton pump inhibitors were continued for 48-72hrs.IV antibiotics (Piperacillin and Tazobactum) was continued for 48hrsand put on oral antibiotics after that for 5-7days.Thrombo-prophylaxis involves subcutaneous Low Molecular weight Heparin(Enoxaparin) was started 12 hrs after the surgery.

Hb% and Packed Cell Volume were checked and blood transfusion was decided if Hb was <9mg% and PCV<27%.

Suction drain was removed after 24hrs as the drain was < 200ml.

He was started physiotherapy in bed on the first post operate day. Static glutei, abductors and quadriceps exercises were started and encouraged prop up and chest physiotherapy and was made to sit up in the bed and also with the legs hanging by the side of the bed but was strictly advice to continue the abduction pillow and not to lie on the operated side for 3-6 weeks.

On the second or third postop day he was made to stand up and walk with partial weight bearing using walker. A high western commode seat toilet was advised for 3 months.

He was discharged after removal of sutures on 15th postoperate day.

Advised care at home were continue supervised physiotherapy, continue walker for 6 -12 weeks and followed by cane in the contralateral side, avoid stair climbing upto 6-12 weeks. He was advised to followup at 3weeks,6 weeks,3months,6months and half yearly thereafter for Harris HIP Scoring and radiological evaluation for acetabular cup migration,femoral stem subsidence,loosening and osseointegration using X-Ray pelvis with both hip and Computed Tomographic scan of pelvis with both hips.

CASE- 2

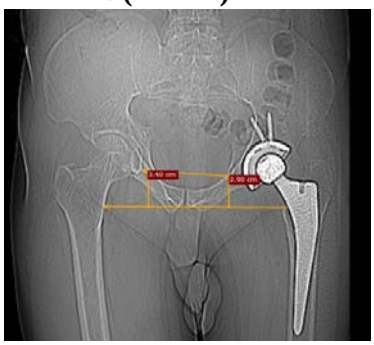
PREOP CLINICAL PHOTO

PREOP XRAY

POSTOP CLINICAL ASSESSMENT

POSTOP RADIOLOGICAL ASSESSMENT

LLD(XRAY)



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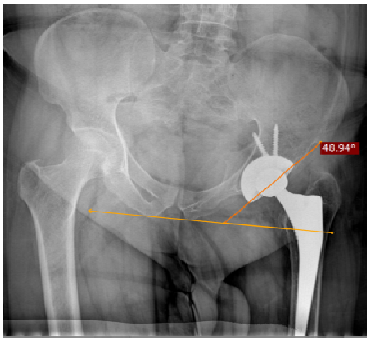
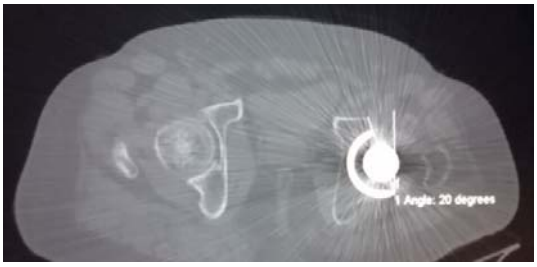
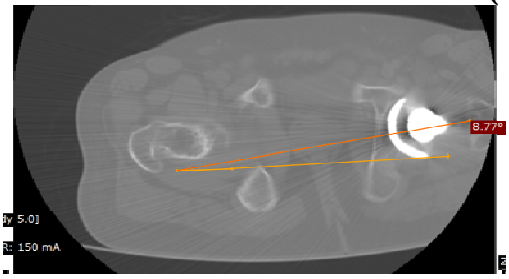


ACETABULAR CUP ANTEVERSION(CT)



FEMORAL STEM ANTEVERSION(CT)



Case 3

60 year old male presented to the emergency trauma ward alleged history of accidental fall from bicycle with complaints of pain left hip and unable to walk .

The pain was sudden in onset and progressively increasing in intensity, not radiating to knee , sharp, aggravated during activities not relieve by rest. There was no any distal neurovascular deficit. No other associated injuries and co morbidity. He was admitted and put on skeletal traction and underwent all necessary investigations. He was examined for limb length discrepancy, fixed deformities, active and passive range of movements at the affected hip, distal neurovascular deficit, status of other joints and any focus of infection(skin, dental and urinary tract). His was subjected to preoperative Harris Hip Scoring system analysis. He has been diagnosed fracture neck of femur left side.

He was assessed for suitable anaesthesia for cementless total hip replacement of left side hip after a fair trial of conservative management and obtain consent for THR to improve in quality of life.

He was operated on 09-01-15and intraop was uneventful..He was transported in supine with operated limb abducted by a pillow. In the postop ward he was connected to multipara monitor to monitor his vitals. He was also monitored for urine output, soakage and drain output .He was permitted to lie in lateral position on the non operative side while maintain the pillow between the knees to prevent bedsore formation. He was encouraged ankle and toe mobilization in bed as soon as the motor function recovers.

Analgesics (paracetamol and tramadol) and antacids were continued for 48-72hrs.IV antibiotics(Piperacillin and Tazobactum) was continued for 48hrsand put on oral antibiotics after that for 5-7days.Thrombo-prophylaxis involves subcutaneous Low Molecular weight Heparin(Enoxaparin) was started 12 hrs after the surgery.

Hb% and Packed Cell Volume were checked and blood transfusion was decided if Hb was <9mg% and PCV<27%.

Suction drain was removed after 48hrs as the drain was < 100ml.

He was started physiotherapy in bed on the first post operate day. Static glutei, abductors and quadriceps exercises were started and encouraged prop up and chest physiotherapy and was made to sit up in the bed and also with the legs hanging by the side of the bed but was strictly advice to continue the abduction pillow and not to lie on the operated side for 3-6 weeks.

On the third postop day he was made to stand up and walk with partial weight bearing using walker. A high western commode seat toilet was advised for 3 months.

He was discharged after removal of sutures on 15th postoperate day.

Advised care at home were continue supervised physiotherapy, continue walker for 6 -12 weeks and followed by cane in the contralateral side, avoid stair climbing upto6-12 weeks. He was advised to followup at 3weeks,6 weeks,3months,6months and half yearly thereafter for Harris HIP Scoring and radiological evaluation for acetabular cup migration, femoral stem

subsidence,loosening and osseointegration using X-Ray pelvis with both hip and Computed Tomographic scan of pelvis with both hips.

Case- 3

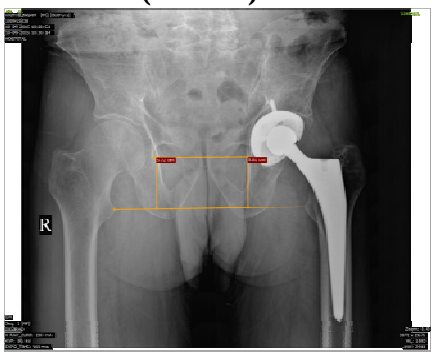
PREOP CLINICAL PHOTO

PREOP XRAY

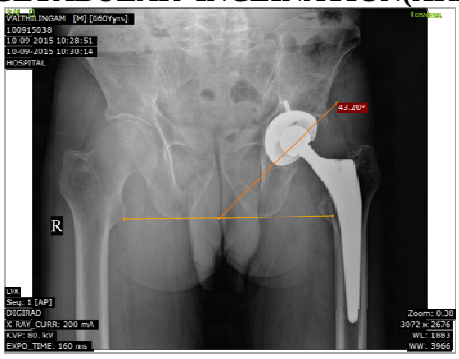
POSTOP CLINICAL ASSESSMENT

POSTOP RADIOLOGICAL ASSESSMENT

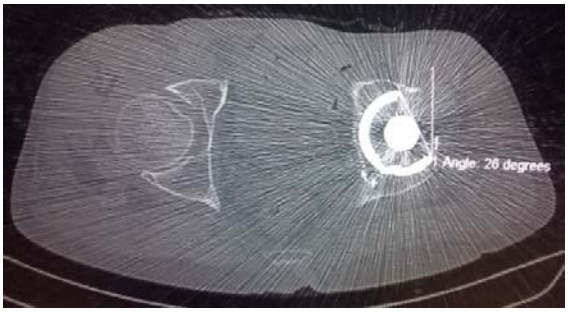
LLD(X-RAY)



ACETABULAR INCLINATION(XRAY)



ACETABULAR CUP ANTEVERSION(CT)



FEMORAL STEM ANTEVERSION(CT)

Case 4

30 year old female came with history of limp for the past 1 year. The limp was gradual in onset and progressively increasing . She had pain over the right groin 1 year before the limp develop. On examination of right hip there was only jag of movements at the right hip joint. No other associated injuries and co morbidity.

She was admitted at Thanjavur Medical College Hospital Orthopaedic Department and underwent all necessary investigations. She was examined for limb length discrepancy, fixed deformities, active and passive range of movements at the affected hip, distal neurovascular deficit, status of other joints and any focus of infection(skin,dental and urinary tract). She was subjected to preoperative Harris Hip Scoring system analysis. She has been diagnosed as ankylosis right hip. She was assessed for suitable anaesthesia for cementless total hip replacement of right side hip after a fair trial of conservative management and obtain consent for THR to improve in quality of life.

She was operated on 09-09-14and intraoperate was uneventful..He was transported in supine with operated limb abducted by a pillow. In the postop ward she was connected to multipara monitor to monitor his vitals. She was also monitored for urine output, soakage and drain output..

She was permitted to lie in lateral position on the non operative side while maintain the pillow between the knees to prevent bedsore formation. She was encouraged ankle and toe mobilization in bed as soon as the motor function recovers.

Analgesics and anatacids were continued for 48-72hrs.IV antibiotics(piperacillin and tazobactum) was continued for 48hrsand put on oral antibiotics after that for 5-7days.Thrombo-prophylaxis of subcutaneous Low Molecular weight Heparin(Enoxaparin) was started 12 hrs after the surgery.

Hb% and Packed Cell Volume were checked and blood transfusion was decided if Hb was <9mg% and PCV<27%.

Suction drain was removed after 24hrs as the drain was < 100ml.

She was started physiotherapy in bed on the first post operate day. Static glutei, abductors and quadriceps exercises were started and encouraged prop up and chest physiotherapy and was made to sit up in the bed and also with the legs hanging by the side of the bed but was strictly advised to continue the abduction pillow and not to lie on the operated side for 3-6 weeks.

On the second or third postop day she was made to stand up and walk with partial weight bearing using walker. A high western commode seat toilet was advised.

She was discharged after removal of sutures on 15th postoperate day.

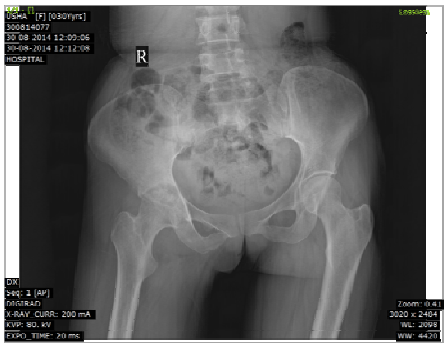
Advised care at home were continue supervised physiotherapy, continue walker for 6 -12 weeks and followed by cane in the contralateral side, avoid

stair climbing upto6-12 weeks. He was advised to followup at 3weeks,6 weeks,3months,6months and half yearly thereafter for Harris

HIP Scoring and radiological evaluation for acetabular cup migration, femoral stem subsidence, loosening and osseointegration using X-Ray pelvis with both hip and Computed Tomographic scan of pelvis with both hips.

Case-4

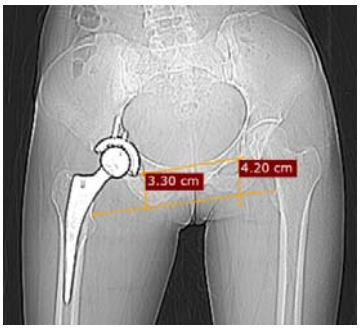
PREOP XRAY



POSTOP POST OP CLINICAL ASSESSMENT

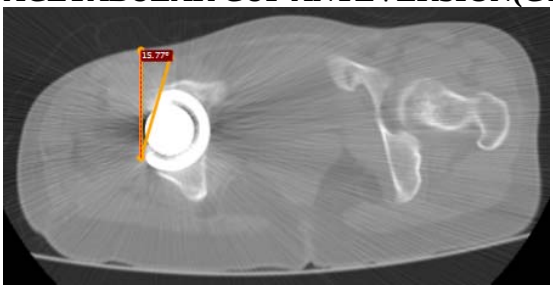
POSTOP RADIOLOGICAL ASSESSMENT

LLD(XRAY)

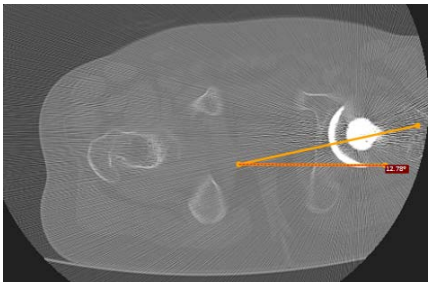


ACETABULAR INCLINATION(XRAY)

ACETABULAR CUP ANTEVERSION(CT)



FEMORAL STEM ANTEVERSION(CT



Case 5

55 year old male came with alleged history of accidental fall from bicycle two and half months ago.

He had closed fracture neck of femur left side. He had increasing pain left groin and difficulty in walking. The pain was sharp and radiate down to his knee. No other associated injuries and co morbidity. He is a chronic smoker for the past 20 years and occasionally alcoholic.

He was admitted at our department and underwent all necessary investigations. He was examined for limb length discrepancy, fixed deformities, active and passive range of movements at the affected hip, distal neurovascular deficit, status of other joints and any focus of infection (skin,dental and urinary tract). His was subjected to preoperative Harris Hip Scoring system analysis. He was diagnosed to have neck of femur fracture. He was assessed for suitable anaesthesia for total hip replacement of left side hip after a fair trial of conservative management and obtain consent for THR to improve in quality of life.

He was operated on 25-06-14and intraoperate was uneventful..He was transported in supine with operated limb abducted by a pillow. In the postop ward he was connected to multipara monitor to monitor his vitals. He was also monitored for urine output ,soakage and drain output..He was permitted to lie in lateral position on the non operative side while maintain the pillow between the knees to prevent bedsore formation.

He was encouraged ankle and toe mobilization in bed as soon as the motor function recovers from spinal anaesthesia.

Analgesics(NSAID, Paracetamol and Tramodol)and proton pump inhibitors was continued for 48-72hrs.IV antibiotics (piperacillin and tazobactum) was continued for 48hrsand put on oral antibiotics after that for 5-7days.Thrombo-prophylaxis involves subcutaneous Low Molecular weight Heparin(Enoxaparin) was started 12 hrs after the surgery.

Hb% and Packed Cell Volume(PCV) were checked and blood transfusion was decided only if Hb was <9mg% and PCV<27%.

Suction drain was removed after 24hrs as the drain was < 150ml.

He was given physiotherapy in bed on the first post operate day. Static glutei,abductors and quadriceps exercises were started and encouraged prop up position and chest physiotherapy and was made to sit up in the bed and also with the legs hanging by the side of the bed but was strictly advice to continue the abduction pillow between the thighs and not to lie on the operated side for 3-6 weeks.

On the third postoperate day he was made to stand up and walk with partial weight bearing using walker. A high western commode seat toilet was advised for 3 months.

He was discharged after removal of sutures on 15th postoperate day.

He was advised care at home with supervised physiotherapy, continue walker for 6 -12 weeks and followed by cane in the contralateral side, avoid stair climbing upto6-12 weeks. He was advised to followup at 3weeks,6 weeks,3months,6months and half yearly thereafter for followup Harris HIP Scoring and radiological evaluation for acetabular cup migration, femoral stem subsidence,loosening and osseointegration using X-Ray pelvis with both hip and Computed Tomographic scan of pelvis with both hips.

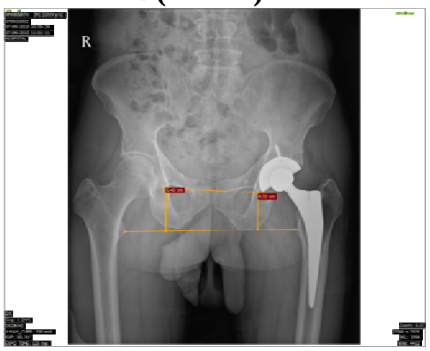
Case 5

PREOP XRAY

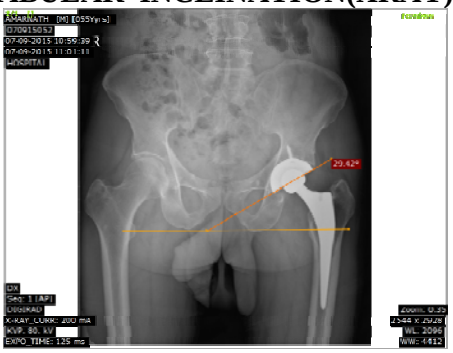
POSTOP POST OP CLINICAL ASSESSMENT

POSTOP RADIOLOGICAL ASSESSMENT

LLD(XRAY)



ACETABULAR INCLINATION(XRAY)



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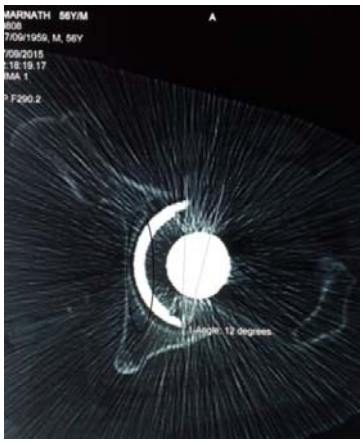

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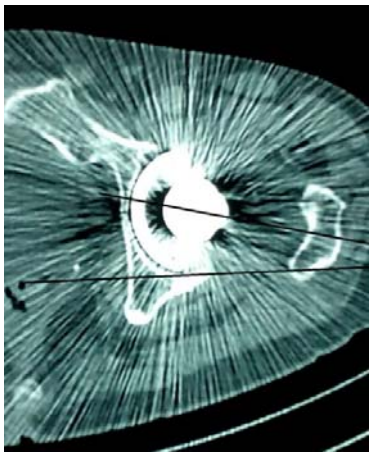
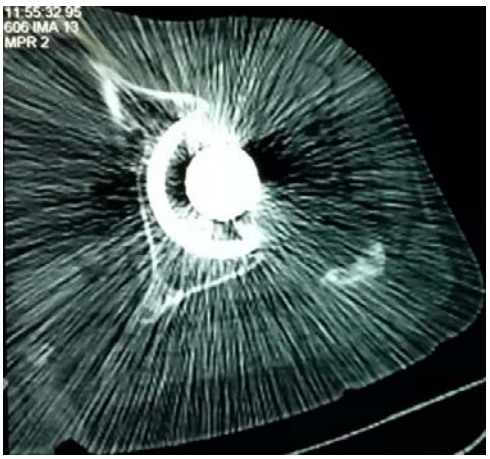


ACETABULAR CUP LOOSENING

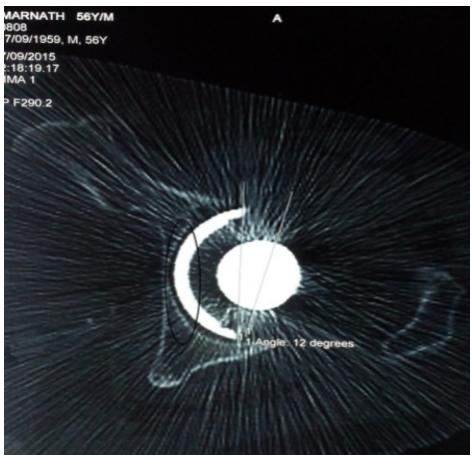
3MONTHS POST OP

ACETABULAR CUP SHOWS <1MM RLL

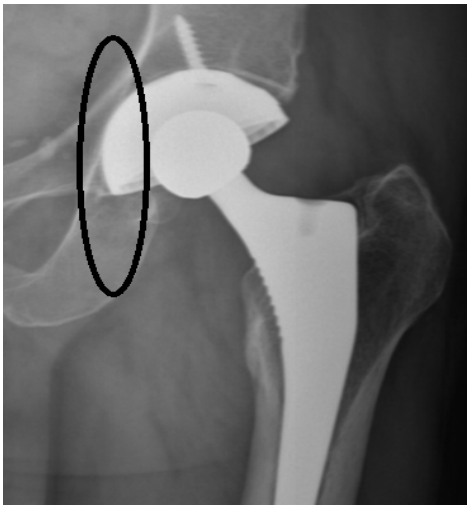


1 YEAR POST OP

ACETABULAR CUP SHOWS RLL >1MM



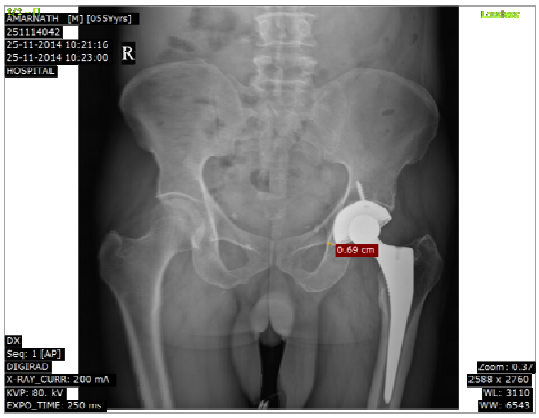
3 MONTHS POSTOP X-RAY



1 YEAR POSTOP X-RAY SHOWS RLL

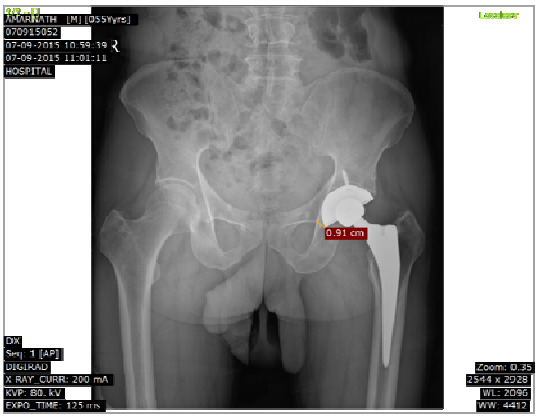
3MONTHS POSTOP

ACETABULAR CUP MIGRATION



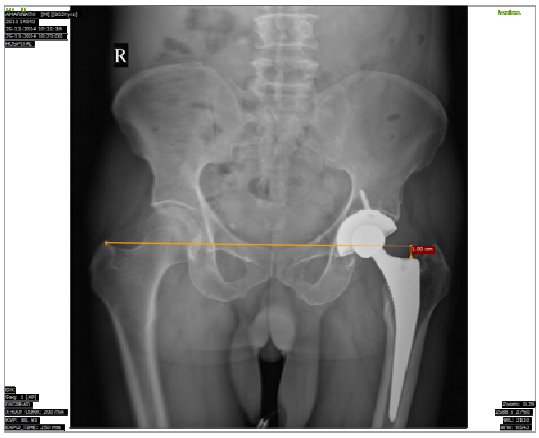
1YEAR POSTOP

ACETABULAR CUP MIGRATION



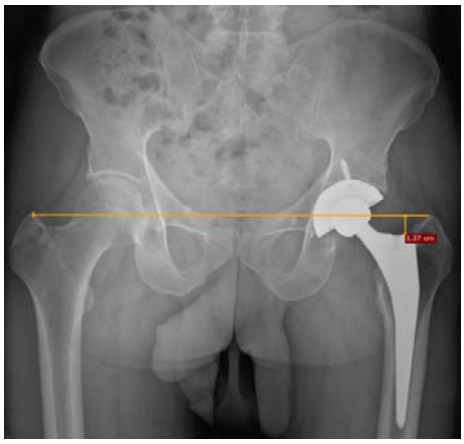
3MONTHS POSTOP

FEMORAL STEM SUBSIDENCE



1YEAR POSTOP

FEMORAL STEM SUBSIDENCE



Case 6

25 year old female came with history of pain right groin and limp for the past 2 years.

The pain was gradual in onset ,progress in intensity , radiate down to his knee, dullaching, aggravated during activities like squatting and crossleg sitting, not relieve by rest. No other associated injuries and co morbidity. She was undergone total hip replacement surgery 1 year back on the left side hip for osteonecrosis of left hip. No family members suffering from similar illness.

She was admitted at our department and underwent all necessary investigations. She was examined for limb length discrepancy, fixed deformities, active and passive range of movements at the affected hip, distal neurovascular deficit, status of other joints and any focus of infection(skin, dental and urinary tract). She was subjected to preoperative Harris Hip Scoring system analysis. She has been diagnosed as Osteonecrosis right hip. She was assessed for suitable anaesthesia for total hip replacement of right side hip and obtain consent for total hip replacement to improve in quality of life.

She was operated on 18-12-13and intraoperate was uneventful..He was transported in supine with operated limb abducted by a pillow. In the postop ward she was connected to multipara monitor to monitor his vitals. She was also monitored for urine output, soakage and drain output. He was permitted to lie in lateral position on the nonoperative side while maintain the pillow

between the knees to prevent bedsore formation. She was encouraged ankle and toe mobilization in bed as soon as the motor function recovers.

Analgesics and anatacids were continued for 48-72hrs.IV antibiotics(piperacillin and tazobactum) was continued for 48hrsand put on oral antibiotics after that for 5-7days.Thrombo-prophylaxis of subcutaneous Low Molecular weight Heparin(Enoxaparin) was started 12 hrs after the surgery.

Hb% and Packed Cell Volume(PCV) were checked and blood transfusion was decided if Hb was <9mg% and PCV<27%.

The suction drain was removed after 24hrs as the drain was < 200ml.

She was started physiotherapy in bed on the first post operate day. Static glutei,abductors and quadriceps exercises were started and encouraged prop up position and chest physiotherapy and was made to sit up in the bed and also with the legs hanging by the side of the bed but was strictly advised to continue the abduction pillow and not to lie on the operated side for 3-6 weeks.

On the third postoperate day she was made to stand up and walk with partial weight bearing using walker. A high western commode seat toilet was advised.

He was discharged after removal of sutures on 15th postoperate day.

Advised care at home were continue supervised physiotherapy, continue walker for 6 -12 weeks and followed by cane in the contralateral side, avoid stair climbing upto6-12 weeks. He was advised to followup at 3weeks,6 weeks,3months,6months and half yearly thereafter for followup Harris HIP

Scoring and radiological evaluation for acetabular cup migration, femoral stem subsidence, loosening and osseointegration using X-Ray pelvis with both hip and Computed Tomographic scan of pelvis with both hips.

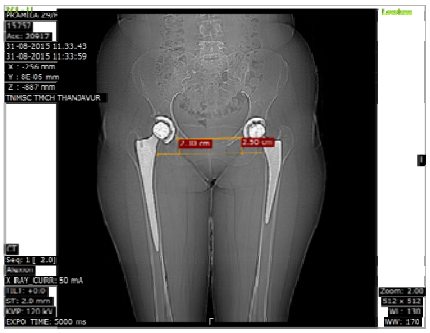
CASE 6

PREOP CLINICAL PHOTO

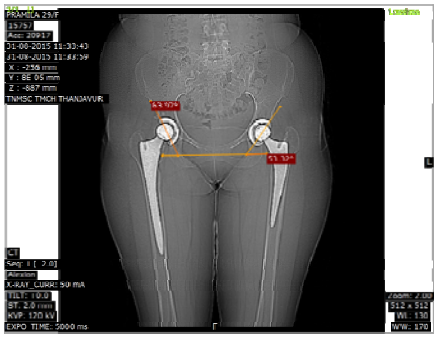
PEROP X-RAY

POST OP CLINICAL PHOTO

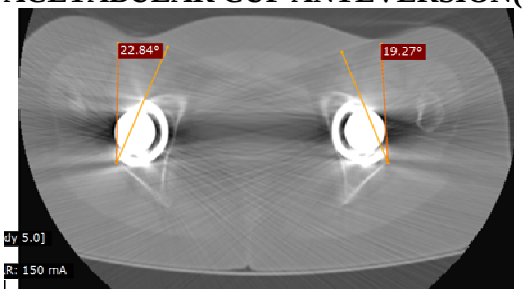
LLD(X-RAY)



ACETABULAR CUP INCLINATION(X-RAY)



ACETABULAR CUP ANTEVERSION(CT)



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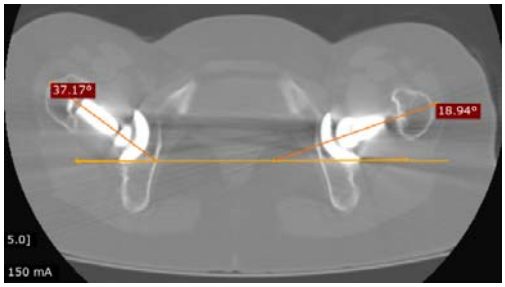


Results

Clinical evaluation

Table – I

AGE DISTRIBUTION

No	Age in Years	No. of Cases	%
1	<20	2	13.3%
2	20 to 30	2	13.3%
3	31 to 40	3	20%
4	41 to 50	2	13.3%
5	>50	6	40%

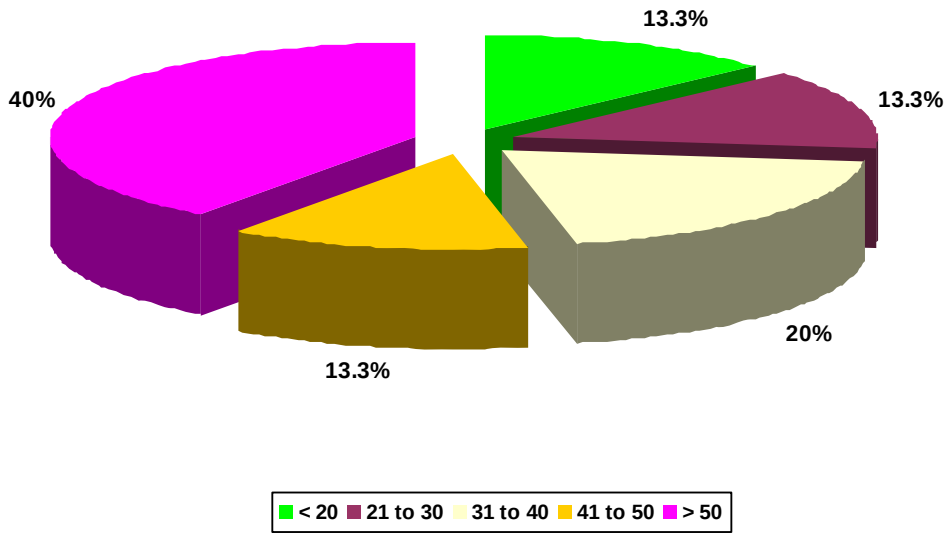
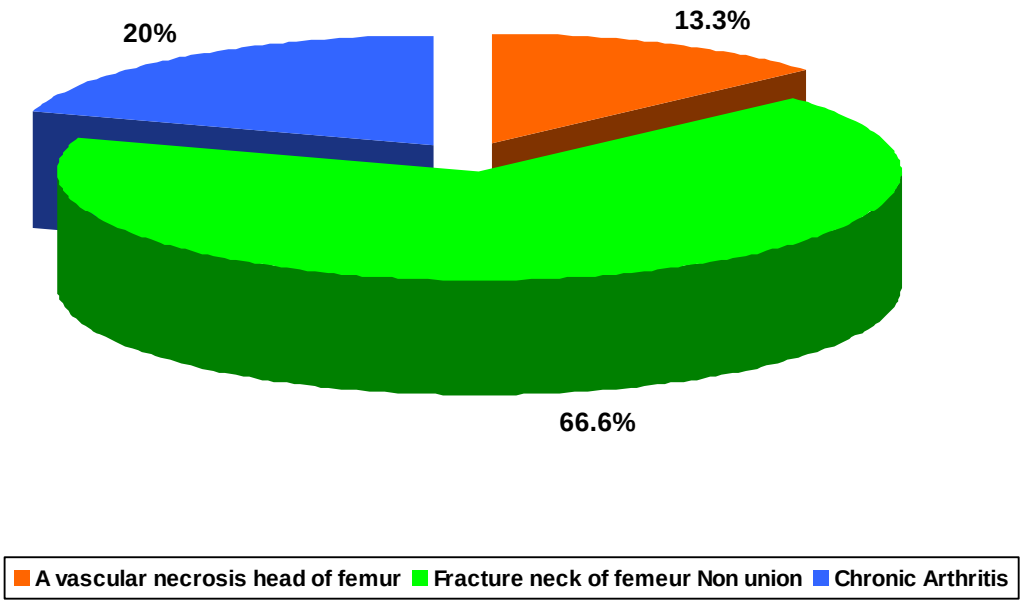


Table – II

INDICATIONS

No	Indications	No. of Cases	%
1	Avascular necrosis Head of femur	2	13.3%
2	Fracture neck of Femur Non Union	10	66.6%
3	Chronic Arthritis	3	20%



Results

Clinical Results

Among the 14 patients with 15 hip replacements(one bilateral) , the over all improvement in average Harris hip score was from 29.9 pre operatively to 91.4 post operatively (TableIII) and only in 1 case we observed deterioration in Harris hip score by loosening, but it still gave fair result.

As rated with Harris hip score, the average pain score pre operatively and one-year post operatively were 19.3 and 40 points respectively. 94.3 percent of patients had no or slight pain in 1 year followup. The prevalence of anterior thigh pain was 6.7% in the 1 year follow up evaluation.

In the post operative period none of the patients developed dislocation,.

The clinical result of HHS was evaluated for statistical significant using Wilcoxan Signed Rank Test in six stages from immediate to 1 year followup period.

Table III Clinical Out Come

No	Clinical Evaluation	Pre .Op	Post Op.
1	Harris Hip Score 100 (Average)	29.9	91.4
2	Pain Score 0 to 44 (Average)	19.3	40
3	Anterior thigh pain (No.of patients)	-	1
4	Heterotrophic Ossification (No.of Patients)	-	0

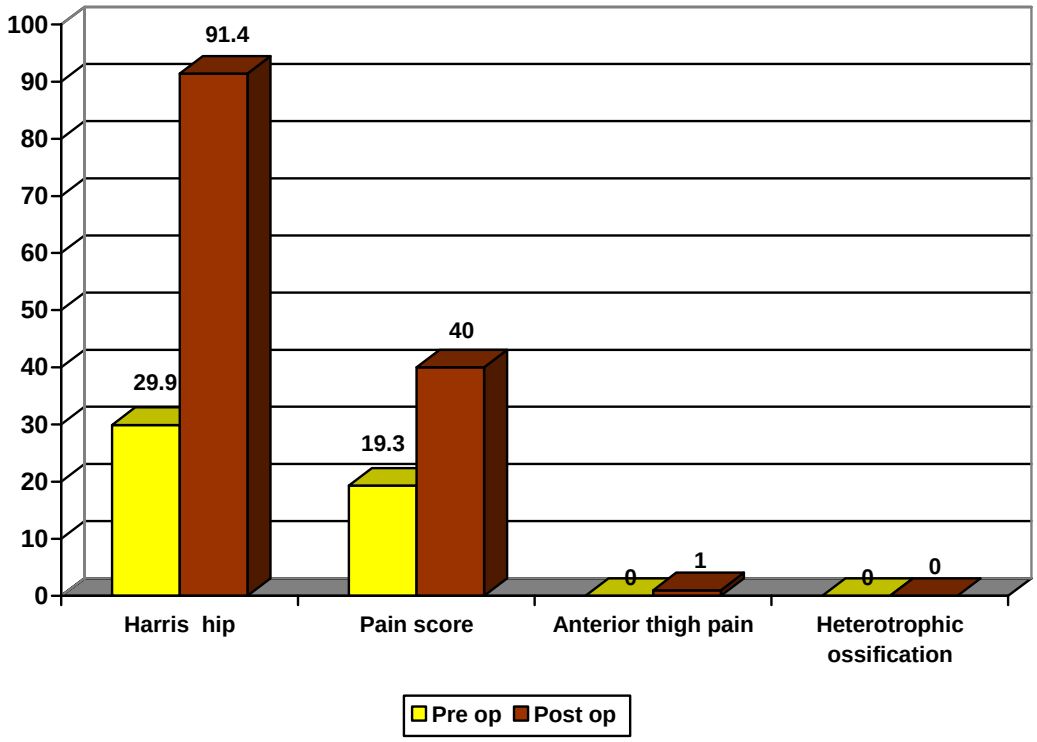
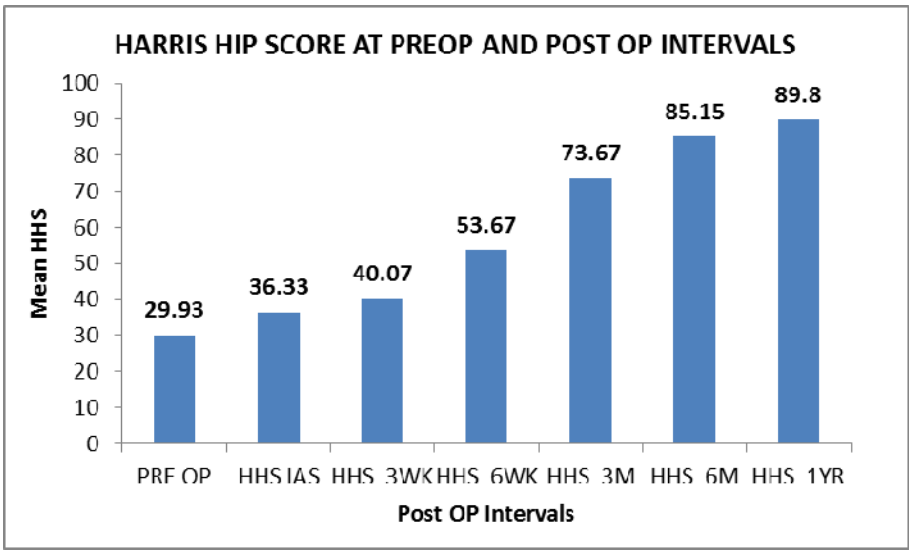


Table IV Harris Hip Score

HSS Score	Mean HSS	Minimum	Maximum
PRE OP	29.93	18	41
HHS IAS	36.33	35	37
HHS 3WK	40.07	39	42
HHS 6WK	53.67	43	57
HHS 3M	73.67	70	76
HHS 6M	85.15	73	88
HHS 1YR	89.8	76	96



Wilcoxon Signed Rank Test

Variable	Mean ± SD (Minimum- Maximum)		P value
	PRE OP	HHS IMMED POSTOP	
HH Score	29.93 ± 9.42(18-41)	36.33 ± 0.98(35-37)	0.053

Variable	Mean ± SD (Minimum- Maximum)		P value
	PRE OP	HHS 3WK	
HH Score	29.93 ± 9.42(18-41)	40.07 ± 1.28(39-42)	0.001

Variable	Mean ± SD (Minimum- Maximum)		P value
	PRE OP	HHS 6WK	
HH Score	29.93 ± 9.42(18-41)	53.67 ± 4.52(43-57)	0.001

Variable	Mean ± SD (Minimum- Maximum)		P value
	PRE OP	HHS 3M	
HH Score	29.93 ± 9.42(18-41)	73.67 ± 2.19(70-76)	0.001

Variable	Mean ± SD (Minimum- Maximum)		P value
	PRE OP	HHS 6M	
HH Score	29.93 ± 9.42(18-41)	85.15 ± 4.62(73-88)	0.001

Variable	Mean ± SD (Minimum- Maximum)		P value
	PRE OP	HHS 1Year	
HH Score	29.93 ± 9.42(18-41)	89.8 ± 5.29(76-96)	0.005

Interpretation for Above 6 tables :

The pre-operative mean HH score was 29.93 ± 9.42 with a range of 18 to 41 increased to 36.33 ± 0.98 at immediate post-operative.. This increase shows trend towards statistical significance (P=0.053).

Three weeks follow-up mean HH score was 53.67 ± 4.52 with a range of 43 to 57. This increase from pre-operative HHS show a statistical significance (P=0.001).

Six weeks follow-up mean HH score was 53.67 ± 4.52 with a range of 70 to 76. This improvement from pre-operative HHS show a statistical significance (P=0.001).

Three months follow-up mean HH score was 73.67 ± 2.19 with a range of 70 to 76. The improvement observed at six weeks from pre-operative HHS show a statistical significance (P=0.001).

Six months follow-up mean HH score was 85.15 ± 4.62 with a range of 73 to 88. This increase from pre-operative HHS show a statistical significance (P=0.001).

At the end of one year the mean HH score improved to 89.8 ± 5.29 compared to 29.93 ± 9.42 at pre-operative. This increase from pre-operative HHS show a statistical significance improvement (P=0.005).

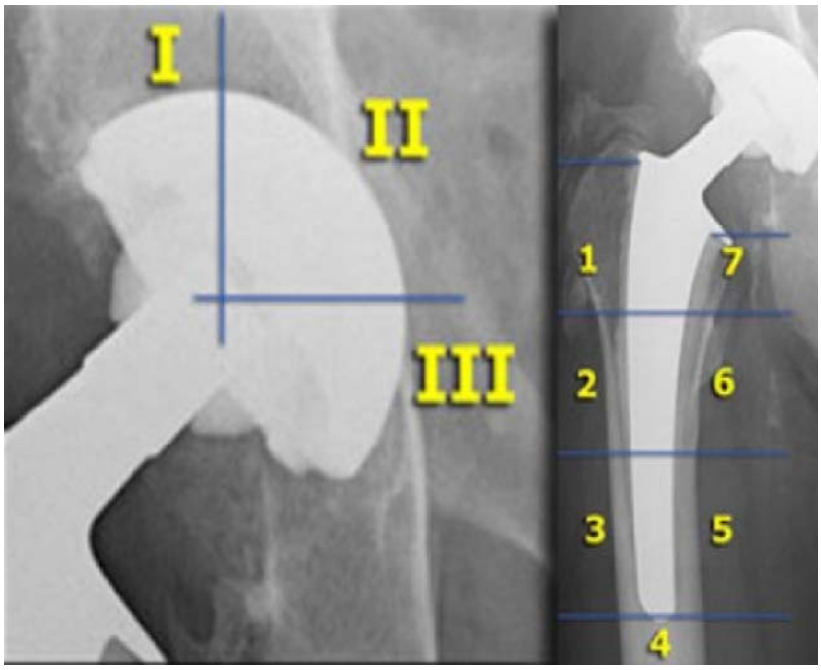
Radiographic Evaluation

Radiographs were ordered in each hip immediately after the operation, at 3 weeks,6 weeks, 3 months , 6 months and also at yearly intervals. These are the standard antero posterior radiograph of pelvis and antero posterior radiograph of hip showing upto the lower end of femoral prosthesis.

The radiographs were cautiously reviewed to determine the presence and progression of radiodense and radiolucent lines, the position and migration of the acetabular cup and femoral components , the extent of femoral component filling in the intra medullary canal, the remodeling of host bone around the implant and heterotrophic bone formation .

Solid fixation was indicated by Spot Welds and trabeculae of cancellous host bone extending to the stem of the prosthesis.

Each component was assessed for the presence and progressions of radio dense lines at 7 zones (Gruen) along femoral component and three zones (DeLee and Charnley) along the acetabular component. (Fig 14a)



DeLee and Chanley Gruen zones

Fig-14a

Radiographic Analysis Result

The following radiographic findings were noted when serial radiographs, including those made in the latest follow up examinations were compared.

When considering the acetabular component,using DeLee and Charnley Zones, there was no significant radioluncency in Zone 1 and 2.

But in **6.7** % of our patients there was a significant translucency in the zone 3, which is a non- weight bearing area of the implant.

There was no significant fresh bone formation in acetabular or femoral prosthesis and bone interface.

One patient developed periprosthetic osteolysis and loosening of acetabulum. (fig-14)

Table

RADIOGRAPHIC ANALYSIS

Acetabulum

No	Finding in post op evaluation	No.of cases	%
1	Radio Dense lines	Nil	-
	Zone 1	Nil	-
	Zone 2	Nil	-
	Zone 3	Nil	-
2	Radio lucent lines	Nil	-
	Zone 1	Nil	-
	Zone 2	Nil	-
	Zone 3	1	6.7%

Femur

No	Finding in post op evaluation	No. of Cases	%
1	Radio dense lines		
	>4 zones	0	0%
	1 to 4 zones	1	6.7%
	No Zones	0	0%
2	Significant osteolysis	1	6.7%

For the femoral component there was no radiodense bone in more than 4 zones (Gruen) in the 12 months average follow up period . Only 6.7% of cases had radiodense bone in 1 to 4 zone. 94.3 percent had no significant radiodense lines around femoral component.

Increased radiolucence were noted only in 1 patient in the post operative period who had a fair Harris hip score of 76.

Heterotrophic ossification was noted in none of the patients. Since our followup period was less than 2 years.

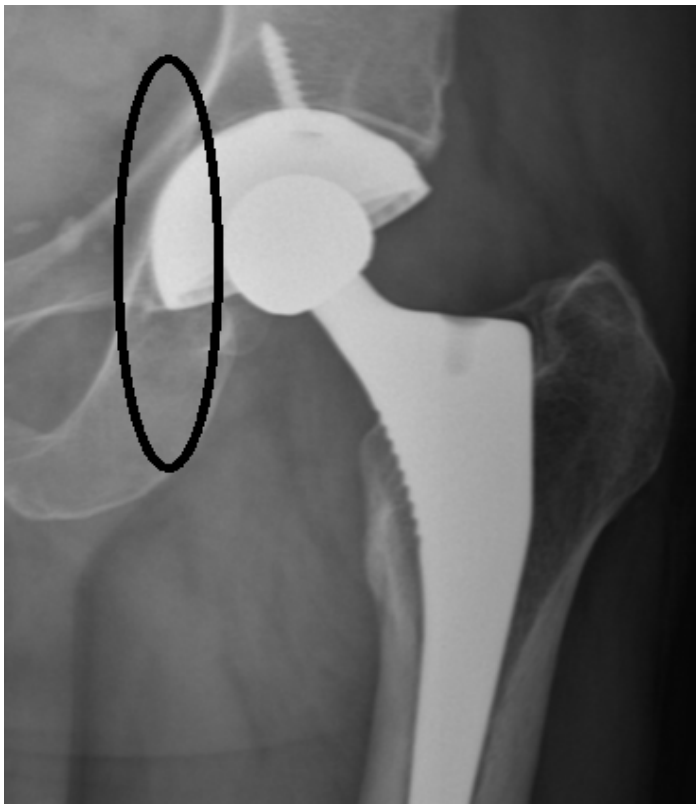


Fig-14b 3 months postoperate zone-3

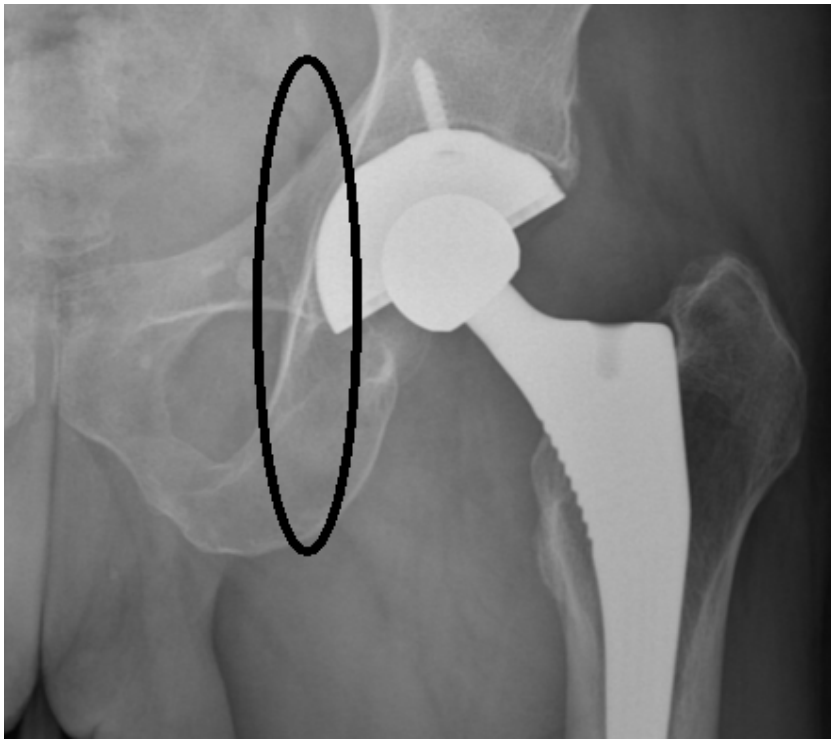


Fig-14c 1 year postoperate DeLee & Chanley zone 3

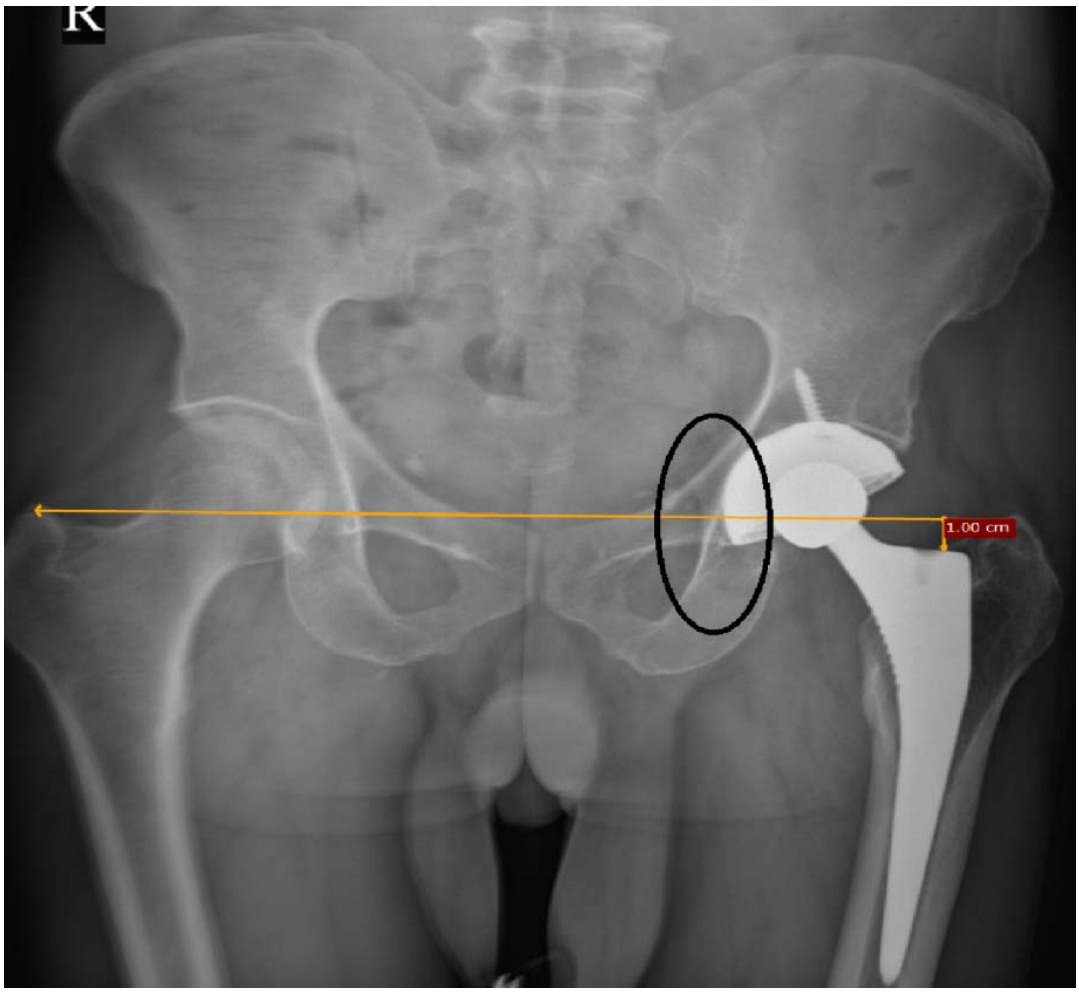


Fig-14d

3 months postoperate

Distance of femoral stem from tip of greater trochanter=1.00cm

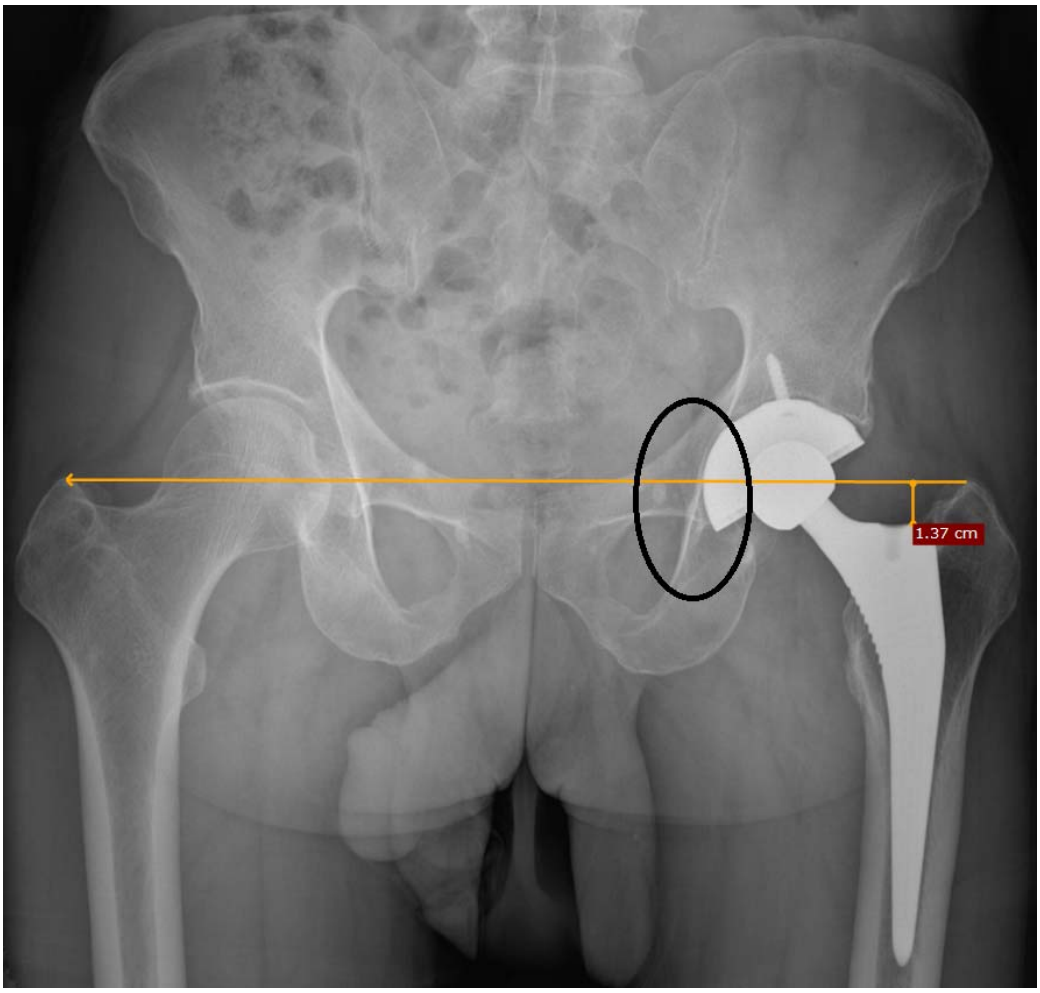


Fig-14e 1 year postoperate

Distance of femoral stem from the tip of the greater trochanter=1.37cm

Femoral stem migration of 0.37cm(3.7mm)

CT Scan Evaluation

CT Scans were done for some of the patients 3 months to 1 year after operation and also with follow up dates. These patients had regular Anteroposterior radiographs as already described there were scattered radiation lines were generaly produced by metal implants in the CT scanners metal artifact with bone ingrowth was difficult to interprete.and they were suppressed.While doing cross sections in transverse planes in CT Scan, for acetabular component ,the zones described by Delee and Charnley were kept as guidelines.

The section was planned so as to cover zones, 1,2 and 3 of Delee and charnley in that order (Fig 14)

But in newer machines these artifacts were suppressed. This allowed the images of the implanted hip and hence their measurements to be done more accurate.

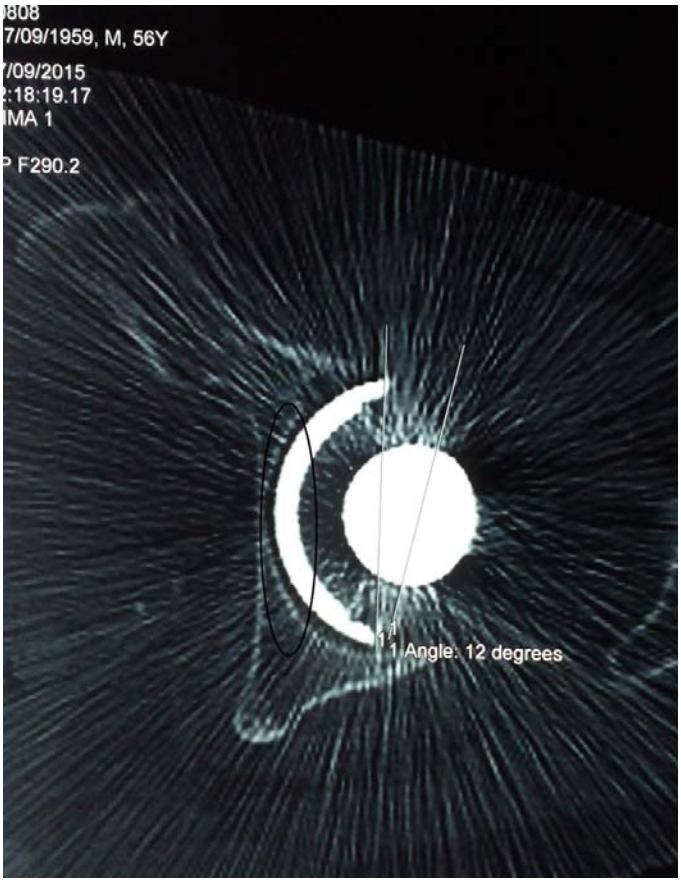


Fig-14

1 year followup CT scan showing Radiolucency

For femoral component the zones described by Gruen et al. were kept as guideline. But due to metal artifact interpretation of bone ingrowth was not possible.

In immediate post operative CT Scan primary press fit of components were noted by impaction of the triangular projections in acetabulum and femoral stem ribs into the endosteal surface of femur.

In post operative CT Scans of 3 to 12 months, the presence of any new bone in prosthetic bone interface or osteolysis in sections 1,2,3 for acetabular component and in sections 4,56 and 7 for femoral components were observed.

CT Scan Analysis Results

The available CT Scans did not show any new bone formation around acetabular component in section 1 to 3.

Radiolucent areas were seen in **1** patient in the section 3 (6.7%)

New bone formation in the femoral prosthetic bone interface was not demonstrated in any of the patients.

Femoral endosteal new bone was not seen in any sections in any patients,still these patients showed excellent clinical results.

Significant osteolysis was noticed in 6.7% of cases. No osteolysis were noticed in the remaining patients.

The 94% of patients showed no significant osteolysis, but had a good clinical out come with average Harris Hip Score of 92.

6.7% of patients had significant osteolysis with fair clinical out come with average Harris Hip Score of 76 (the loosened case).

Table

CT Scan Analysis

Femoral Component

No	Findings in post operative analysis	No. of Cases	%
1	Endosteal New Bone		
	Total	0	0%
	>2 Section	0	0%
	1 to 2 Section	0	0%
2	Osteolysis	1	6.7%
3	No changes	14	93.3%

Discussion

The purpose of the study was to analyse the post operative radiographic and CT Scan features that can predict osteo-integration and the final success of uncemented total hip arthroplasties. *Engh et al* found no significant acetabular changes in radiography. In this study also we were not able to find any significant, constant pattern of new bone formation around acetabular component radio graphically and also with CT scan.

Engh et al [29] described the radiographic signs of fixation and stabilities of stem inserted without cement. The lack of reactive lines and presence of spot welds of new bones around the surface can be called as osteointegration.

In our study there was good improvement in pain score, and no anterior thigh pain in cases where there was no significant osteointergration seen in roentengenograph and CT scan.

94% patients showing no significant osteolysis had excellent clinical outcome with average Harris Hip Score of 92 only 6.7% had osteolysis(loosening in both radiology and CT scan) with fair clinical outcome with average Harris Hip Score of 76.

In 1969 Harris in his work on mold arthroplasty has done a set of parameters based on which the clinical results of the hips operated were assessed. He took with account pain, functional components,absence of deformity and range of movements of the concerned hips.

The ultimate test of osteointergration is histology.

Pidhorz and concern in 1993 has done excellent work on acetabular components retrieved in autopsy cases. They found that there was sites where there was more radiographic evidence in the radiograph of the deceased patient. There was also good amount of osteointegration.They also found if the screw holes were left free, there was polyethylene debris from the implant

Without any granuloma or osteointegration.They also found that metal debris in holes with or without screws were the same.

Peter's et al in 1995, studied a large number(49) revised cemented femoral components with uncemented components. They found significant improvement in Harris Hip Score of the revised hips.

Marco F et all found that the osteointegration observed as lamellar bone has not exactly reflect the turnover of new bone possibly due to dynamic rate of the prosthesis.

According to Rocco P et al there was no differences of periacetabular bone density changes in total hip replacement cases in one year followup.

Kastius A. et al also has reviewed 50 cases of total hip replacement at one year follow up and produced their results of acetabular osseointegration and bone density one year after(RM pressfit vitamys) acetabular cup implantation.

Modern CT Scan machines can cut reflections from metals and can produce better images. There is only uniplanar demonstration of implant in

radiographs of the endosteal new bone formation . but it can be examined circumferentially by CT Scan .Thus bettering the radiography in demonstrating any osteointegratio, there are recent studies of one year follow up is enough for the assessment of uncemented total hip replacement.

limitations of the study

1. With all radiographic reviews it was dependent on the observations and interpretations of the reviewers.
2. For CT scan analysis no comparative analysis was available in the literature to retrieve the results.

Conclusion

This is a short term study of one particular type of uncemented Total Hip Replacement system without comparison with matched or randomized group.

In this study clinical assessment correlated well with radiographic apperance and CT scan. There were no evidences of osteointegration in any case possibly because of short duration of study. There was evidence of loosening in only one case.

In the postoperative Harris Hip Score the neck of femur groups and the arthritic hip groups had comparable results.

Uncemented total hip replacement gives acceptable results in otherwise disabling condition of hip.

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Proforma

Uncementted THR

Case Followup Record

Name : Age: Sex:

Address: D.O.A

D.O.S

D.O.D

Op/IP.No:

DIAGNOSIS:

ASSOCIATED INJURY

PAIN : 44 POINTS						
None /Ignore	44					
Slight /Compromised	40					
On Unusual activity	30					
Moderate /to lerable	20					
Marked /limiatation	10					
Total disability	0					
FUNCTION 47						
Gait 33						
1. Limp						
None	11					
Slight	8					
Moderate	5					
Unable to walk	0					
2. Support						

None	11					
Cane for long walk	7					
Cane full time	5					
Crutch	4					
Two canes	2					
Two Crutch/not walk	0					
3. Distance walked						
Unlimited	11					
Six blocks	8					
Two/three locks	5					
Indoor	2					
Bed/chair	0					
FUNCTIONAL ACTIVITIES 14						
1. Starts						
Normally	4					
Normally with banister	2					
Any method	1					
Not able	0					
2. Bends forwards						
With ease	4					
With difficulty	2					
Unable	0					
3. Sitting						
Any Chair 1 hr	5					
High Chair ½ hr	3					
Unable to sit any chair	0					
4. Enter public transport						
Able to use	1					
Not able to use	0					
DEFORMITIES						

Flexion					
Extension					
Abduction					
Adduction					
Ext. rotation					
Int. rotation					
MOVEMENTS					
Flexion					
Extension					
Abduction					
Adduction					
Ext/ rotation					
Int. rotation					
MEASUREMENTS					
1. Limb length discirpency Lenghthening /sjortening					
2. Thigh circumference					
TELESCOPY					
TRENDELENBERG					
ANTR. THIGH PAIN					
HARRIS HIP SCORE					
PAIN (44)					
GAIT (33)					
FUNCTINS (14)					
DEFORMITY (4)					
ROM (5)					
TOTAL (100)					

Uncemented THR
Radiographic Evaluation

1. ACETABULAM 1. Migration of Cup 2. Y/N mm 3. Tear drop to center of hip				
2. presence of Radio dense lines Zone 1 Zone 2 Zone 3				
3. Presence of Radio lucent lines Y/N Zone 1 Zone 2 Zone 3				
II FEMUR 1. Subsidence Tip of greater Trochanter to Lat Border of stem				
2. Presence of Radio dense lines Y/N Zone 1 Zone 2 Zone 3				

Zone 4 Zone 5 Zone 6 Zone 7				
3. Presence of Radio lucent lines Y/N Zone 1 Zone 2 Zone 3 Zone 4 Zone 5 Zone 6 Zone 7				

CT- Scan Evaluation

1. Primary Press Fit Acetabulam Y/N Femur Y/N				
II Acetabulam 1) Presence of New Bone Y/N Section 1 (zone 1) Section 2(Zone 2) Section 3(Zone 3)				
2. Presence of Osteolysis Y/N Section1 (zone 1) Section 2(zone 2) Section 3 (zone 3)				
III FEMUR: 1) Presence of New bone Y/N Section 4 (zone 1& 7) Section 5 (Zone 2 & 6) Section 6 (Zone 3 & 5) Section 7 (Zone 4)				
2) Presence of Osteolysis Y/N Section 4 (Zone 1&7) Section 5 (Zone 2 & 6) Section 6 (Zone 3 & 5) Section 7 (Zone 4)				

ஆராய்ச்சி தகவல் தாள்

தஞ்சை அரசு மருத்துவமனைக்கு இடுப்பு எலும்பு மூட்டு பாதிக்கப்பட்டு வரும் ஆண் மற்றும் பெண் இரு பாலினருக்கும் முழு இடுப்பு மூட்டு மாற்று அறுவை சிகிச்சை மூலம் சரி செய்யும் நன்மைகளுக்கு ஒரு ஆராய்ச்சி நடைபெற்று வருகின்றது.

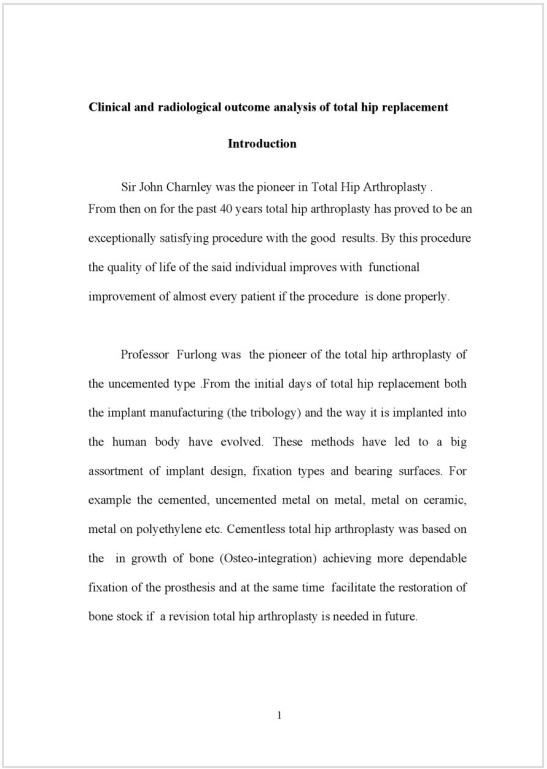
இந்த ஆராய்ச்சியில் நீங்களும் பங்கேற்க வேண்டுகிறோம். இந்த ஆராய்ச்சியில் இடுப்பு எலும்பு மூட்டு பாதிக்கப்பட்டு வரும் ஆண் மற்றும் பெண் இரு பாலினருக்கும் முழு இடுப்பு மாற்று அறுவை சிகிச்சை செய்ய உள்ளோம். இதனால் தங்களது இடுப்பு எலும்பு மூட்டு பிரச்சனைக்கு முழுமையான தீர்வுக்கான வாய்ப்புண்டு என்பதையும் தெரிவித்துக் கொள்கிறோம்.

முடிவுகளை அல்லது கருத்துகளை வெளியிடும் போதோ அல்லது ஆராய்ச்சியின் போதோ தங்களது பெயரையோ அல்லது அடையாளங்களையோ வெளியிட மாட்டோம் என்பதையும் தெரிவித்துக் கொள்கிறோம்.

இந்த ஆராய்ச்சியில் பங்கேற்பது தங்களுடைய விருப்பத்தின் பேரில் தான் இருக்கிறது. மேலும் நீங்கள் எந்நேரமும் இந்த ஆராய்ச்சியிலிருந்து பின் வாங்கலாம் என்பதையும் தெரிவித்துக் கொள்கிறோம்.

இந்த பரிசோதனையின் முடிவுகளை ஆராய்ச்சியின் போது அல்லது ஆராய்ச்சியின் முடிவின் போது தங்களுக்கு அறிவிக்கப்படும் என்பதையும் தெரிவித்துக் கொள்கிறோம்.

ஆராய்ச்சியாளர் கையொப்பம் பங்கேற்பாளர் கையொப்பம்



Clinical and radiological outcome analysis of total hip replacement

Introduction

Sir John Charnley was the pioneer in Total Hip Arthroplasty . From then on for the past 40 years total hip arthroplasty has proved to be an exceptionally satisfying procedure with the good results. By this procedure the quality of life of the said individual improves with functional improvement of almost every patient if the procedure is done properly.

Professor Furlong was the pioneer of the total hip arthroplasty of the uncemented type .From the initial days of total hip replacement both the implant manufacturing (the tribology) and the way it is implanted into the human body have evolved. These methods have led to a big assortment of implant design, fixation types and bearing surfaces. For example the cemented, uncemented metal on metal, metal on ceramic, metal on polyethylene etc. Cementless total hip arthroplasty was based on the in growth of bone (Osteo-integration) achieving more dependable fixation of the prosthesis and at the same time facilitate the restoration of bone stock if a revision total hip arthroplasty is needed in future.

1